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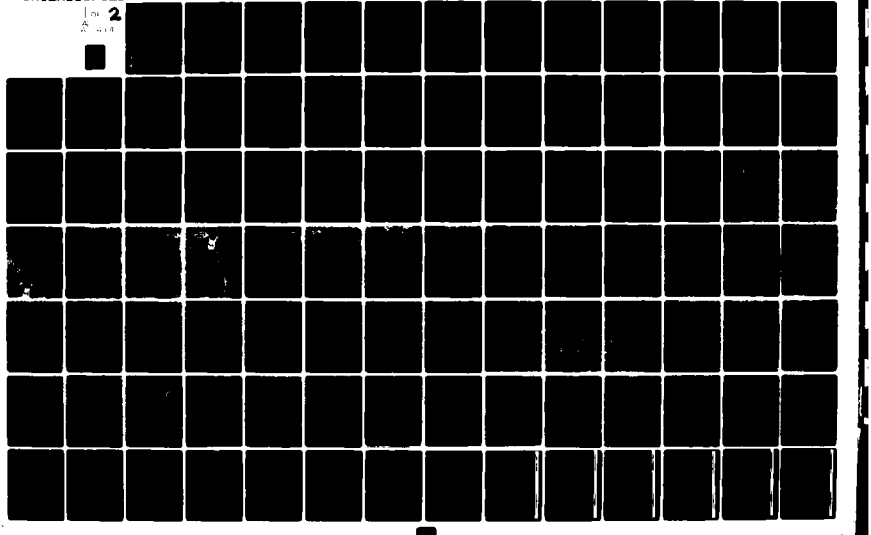


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DETERMINATION OF PRESENCE AND HABITAT SUITABILITY FOR THE INDIANA BAT (MYOTIS SODALIS) AND GRAY BAT (MYOTIS GRISESCENS) FOR THE PINE FORD STUDY AREA, JEFFERSON, WASHINGTON, ST. LOUIS AND FRANKLIN COUNTIES, MISSOURI

SUBMITTED TO THE

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could not be netted. Activity patterns and capture times of different species appeared to be related to the presence of mayfly hatches. The red bat (Lasiurus borealis), was the most common bat captured, comprising fifty-four percent of the total sample. Two federally endangered species, the Indiana bat, (Myotis sodalis) and the gray bat, (Myotis grisescens), also were captured, comprising 2.3 percent and 1.5 percent of the total sample, respectively. Of the nine M. sodalis captured, all were adult males except for two adult females. One lactating female M. sodalis was captured on 1 July and a post-lactating female M. sodalis was captured on 22 July. Of six M. grisescens captured, all were adult males except for one juvenile female captured on 12 August. Subsequent retrapping of areas, in which females of endangered species were captured, indicated no signs of maternity colonies. Overall, the portion of the Big River within the study area produced an average capture of 7.0 bats per net night and a Shannon-Wiener diversity index value of 1.97, indicating a relatively dense and diverse bat fauna.

On 14 August, one trap night and two monitor nights were located on a portion of the Meramec River approximately 5.6 kilometers from its junction with the Mississippi River. These investigations resulted in the capture of one L. borealis and very low activity patterns. The lack of extensive riparian habitat in this area, as well as the poor capture data, indicated a probable lack of an extensive bat fauna in this area.

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Gene Gardner, Biologist, Missouri Dept. of Conservation.

Rick Clawson, Biologist, Missouri Dept. of Conservation.

James Cope, Biologist, Earlham College, Richmond, Indiana.

Bill Mayberry, Naturalist, Washington St. Park, DeSoto, Mo.

Finally, there were all those good people in and around DeSoto, Missouri and the Pine Ford Study Area whose hospitality and cooperation made a difficult project much easier.

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ABSTRACT

From 29 June 1981, through 14 August 1981, fifty five trap nights and four monitor nights on the Big River and its tributaries within the Pine Ford Study Area resulted in the capture of 393 bats of ten species. High mist nets that spanned the river from bank to bank and extended from water level to a height of 7.5 meters were used. Ultrasonic monitors were used to document bat activity levels at net sites and to assess the presence of myotine bats in areas that could not be netted. Activity patterns and capture times of different species appeared to be related to the presence of mayfly hatches. The red bat, (Lasiurus borealis), was the most common bat captured, comprising fifty-four percent of the total sample. Two federally endangered species, the Indiana bat, (Myotis sodalis) and the gray bat, (Myotis grisescens), also were captured, comprising 2.3 percent and 1.5 percent of the total sample, respectively. Of the nine M. sodalis captured, all were adult males except for two adult females. One lactating female M. sodalis was captured on 1 July and a post-lactating female M. sodalis was captured on 22 July. Of six M. grisescens captured, all were adult males except for one juvenile female captured on 12 August. Subsequent retrapping of areas, in

which females of endangered species were captured, indicated no signs of maternity colonies. Overall, the portion of the Big River within the study area produced an average capture of 7.0 bats per net night and a Shannon-Wiener diversity index value of 1.97, indicating a relatively dense and diverse bat fauna.

On 14 August, one trap night and two monitor nights were located on a portion of the Meramec River approximately 5.6 kilometers from its junction with the Mississippi River. These investigations resulted in the capture of one L. borealis and very low activity patterns. The lack of extensive riparian habitat in this area, as well as the poor capture data, indicated a probable lack of an extensive bat fauna in this area.

INTRODUCTION

The purpose of this study was to determine the summer habitat suitability and presence of the Indiana bat (Myotis sodalis) and gray bat (Myotis grisescens) on portions of the Big River and its permanently flowing tributaries within the Pine Ford Study Area. The study area was selected on the basis of the potential loss of forest and riparian habitat to the proposed Pine Ford Lake Project authorized by Section 203, Public Law 89-789 (Flood Control Act of 1966). In addition, several sites along the Meramec River were to be trapped and/or monitored for the presence of different bat species. This study was funded by the St. Louis U.S. Army Engineer District under contract number DACW43-81-C-0130. The work was conducted under a U.S. Fish and Wildlife endangered species permit No. PRT 2-4857 and a scientific collecting permit from the Missouri Department of Conservation.

Thirteen species of bats are known to occur within the state of Missouri (Hall and Kelson, 1959, Barbour and Davis, 1969) (Table 1). Three of these species, M. sodalis, M. grisescens and the Ozark big eared bat, (Plecotus townsendii ingens) currently are listed on the federal endangered species list and one species, the Keens bat (Myotis keeni)

TABLE 1. Status of Bat Species Known to Occur in Missouri

SPECIES	STATUS
Myotis lucifugus (small brown bat)	Common
M. grisescens (gray bat)	Endangered
M. sodalis (Indiana bat)	Endangered
M. leibii (least bat)	Status undertermined
M. keenii (Keens bat)	Rare
Pipistrellus subflavus (eastern pipistrelle)	Common
Nycticeus humeralis (evening bat)	Common
Lasiurus borealis (red bat)	Common
L. cinereus (hoary bat)	Common
Lasionycterus noctivagans (silver haired bat)	Common
Eptescicus fuscus (big brown bat)	Common
Plecotus townsendii ingens (Ozark big-eared bat)*	Endangered
P. rafinesquii (eastern big-eared bat)*	Rare

* Did not occur with the project study area.

is considered rare within the state. Only two of the thirteen species, the Ozark big eared bat (Plecotus townsendii ingens) and the eastern big eared bat (Plecotus rafinesquii), were not known to occur within the study area. A third species, the silver-haired bat (Lasionycteris noctivagans), usually is not found in Missouri during the summer months (LaVal and LaVal, 1980).

With the addition of M. sodalis to the federal endangered species list in 1967 and M. grisescens in 1976, the need for managing the habitat of these two species became an important legal as well as scientific consideration. Although there have been several key studies concerning the status and management of M. sodalis and M. grisescens (Humphrey, 1978; Tuttle, 1980; LaVal and LaVal, 1980; Rabinowitz and Tuttle, 1980), very little has been done concerning their land use associations and presence along potential foraging areas due to the difficulty in obtaining such data.

Both sexes of M. sodalis winter in caves. However, during the summer months, nursery colonies have been found beneath the bark of dead trees in wooded riparian habitat (Cope and Humphrey, 1977; Humphrey et al., 1977; Cope et al., 1978). Foraging habitat during this period includes the foliage of riparian and floodplain trees relatively close to the summer roost (Humphrey et al., 1977). Urbanization and deforestation

have long been considered a factor contributing to the decline of this species (Mohr, 1972).

Humphrey (1978) has speculated that loss of suitable habitat has caused a 50 percent decline of M. sodalis in recent years.

M. grisescens spends both the winter and summer in caves. Summer caves, especially those used by maternity colonies, are located primarily within one kilomoter of rivers or reservoirs over which the bats feed (Tuttle, 1976). Except for periods of inclement weather in early spring and late fall, M. grisescens adults feed almost exclusively over water along river or reservoir edges (LaVal et al., 1977) where they have been shown to feed heavily on mayfly populations (Rabinowitz, 1978). In Missouri, M. grisescens were observed to forage mostly over streams with well developed riparian vegetation, flying as much as 17 kilometers upstream and downstream from the roost cave (LaVal et al., 1977). Environmental disturbance, such as deforestation, is considered a serious threat to the future status of this species (Tuttle, 1979).

Only recently have large, high mist net systems been developed sufficiently to sample bats accurately as they fly and forage along waterways (Cope et al., 1978; Gardner and Gardner, 1980; LaVal and LaVal, 1980). This technique allows

for an in-depth assessment of riparian areas as potential nursery and/or foraging areas for different bat species. Utilizing this technique, we were able to determine the summer habitat suitability and presence of M. sodalis and M. grisescens on portions of the Big River and its permanently flowing tributaries within the Pine Ford Study Area.

MATERIALS AND METHODS

Description of Study Area

The Big River is one of seven major free-flowing rivers remaining in Missouri. It lies within the Big River Basin located in east central Missouri and is a portion of the Meramec River Basin. The Big River originates in the St. Francis Mountain region, an area composed of igneous rocks of Cambrian and pre-Cambrian origin. The majority of its watershed lies within the Salem Plateau province composed of sedimentary limestones and dolomites of Ordovician origin and younger predominate (Mills, Hocutt, and Stauffer, 1978).

The Big River Study Area was selected on the basis of the location of the proposed Pine Ford Lake Project. The Pine Ford Study Area was established between river kilometer 50 at Morse Mills and river kilometer 106 at Washington State Park (Fig. 1 thru 3). This area includes portions of Jefferson, Washington, St. Louis and Franklin Counties, Missouri. Over the 56 kilometer length of the river in the project area, the main channel varied from approximately 30 to 70 meters in width with frequent pools and riffles. The riparian forest strips along the

main channel were dominated by an overstory of sycamore (Platanus occidentialis), maple (Acer spp.) and box elder (Acer negundo) and an understory of poison ivy (Rhus radicans) and stinging nettle (Urtica dioica). All permanently flowing tributaries within the study area, as well as several intermittent streams, also were netted for bats. These areas had the same basic riparian and substrate characteristics but were considerably shallower and varied in width from two to three meters. The bottom substrate of both the main channel and the tributaries varied from rocky to mud bottoms with most areas consisting of some combination of rock, gravel, mud and sand.

One trap night and two monitor nights also were carried out on a portion of the Meramec River. The section of the river studied was approximately 5.6 km from the junction of the Meramec River with the Mississippi River, within the Oakville Quadrangle (Fig. 4). This area was dominated by maples with a mixed understory. The canopy was approximately 21 meters high with virtually no canopy cover over the river. The river was approximately 75 meters wide and over 1.8 meters deep with a substrate consisting primarily of mud.

Trapping of Bats

Live capture of bats flying over the waterway was accomplished with large mist nets (Bleitz Wildlife Foundation, Hollywood, CA.) placed over the river perpendicular to the banks. All mist nets were 38 mm mesh but of variable lengths and heights. On the main channel of the river, mist nets 18 meters long and three meters high, were used almost exclusively. Over tributaries, nets varied from 5.4 meters to 18 meters in length and from 2.1 to three meters in height. Nets were erected over the river by using three interconnecting galvanized steel television antennae poles that reached a height of 7.5 meters. Once the poles were connected, a rope and pulley system was attached, and the were erected on both sides of the river using guy lines. Mist nets then were attached to the pulley system and stacked on top of one another. The nets could then be raised such that all the area between the poles from just above water level to a height of 7.5 meters was covered. In addition, the pulley system allowed for easy and efficient access to captured bats.

Due to the necessity of placing the mist net poles on the banks or in relatively shallow water, sites had to be located that were narrow in width and shallow in depth.

When possible, areas of the stream were also chosen where trees created a tunnel-like effect so that bats would be funnelled into the net. Nets were raised at sundown and checked at intervals of fiteen minutes until midnight. During this time, ultrasonic bat monitors (Westec Services, Inc., San Diego, CA.) were used continually to monitor activity at the trap site. The monitors also could be utilized to indicate when a bat was captured in the net and sometimes the genus of the captured bat. In addition, levels of activity could be compared with trap success to indicate if bats were successful in detecting and avoiding the nets.

Upon capture, bats were removed from the nets as quickly as possible. Medicinal ether was used to anesthetize bats that were tangled severely in the net or when they were to be held for further examination. Data recorded for each bat included species, sex, age, reproductive condition, time of capture and location of capture. Female bats were diagnosed as lactating or post-lactating on the basis of teat examination. The assignment of bats into either an adult or juvenile category was determined by closure of the phalangeal epiphyses. Bats were designated as juveniles by their small overall size and incomplete ossification

of the epiphysis. All bats captured and examined were released immediately unharmed at the site of capture that same night.

Trapping on the Meramec River had to be carried out somewhat differently due to the width and depth of the river. The mist net was placed only on one bank running out over the shoreline perpendicular to the river. This allowed for the capture of bats foraging or flying along the shoreline.

Trap Sites

The study area was broken into three sections: lower, middle and upper river kilometers. This division was necessary due to the short field time alloted for the program and the requirement that the entire study area would be sampled. These three sections were sampled continuously through the sampling period in order that a change in bat utilization could be detected.

Based upon M. sodalis optimal riparian habitat, the entire study area was classified into four categories. These categories were:

I. No trees on either bank

II. Scattered small trees (less than 16" dbh)

III. Mature trees on both banks (Greater than 16"

dbh) with less than three meters overhanging branches

IV. Mature trees on both banks (greater than 16" dbh) with greater than three meters overhanging branches.

Trap sites were selected based upon four criteria. These criteria are listed below in order of their importance:

1. Trap sites should be approximately one kilometer apart.
2. Trap sites had to be in M. sodalis riparian habitat categories III or IV.
3. Trap sites had to be relatively narrow and shallow in order that a 18 meter long net could cover the flyway sufficiently and allow for adequate bat removal upon capture.
4. Trap sites had to approximate 100 percent cover between riparian canopies in order to create a tunnel-like effect so that virtually all bats passing through the flyway could be captured.

The trap site spacing was given number one priority based upon previous studies of M. sodalis. The foraging range of observed female M. sodalis and their young around

maternity colonies has been reported to be 0.8 km (Humphrey et al., 1977) and 1.2 km (Cope et al., 1978). Nets placed approximately 1 km apart along the entire project area should have guaranteed the capture of M. sodalis and their young if any maternity colony was in the area.

In areas which could not be trapped due to the width and/or depth of the river, bat monitors were utilized to document activity patterns and to assess the presence of myotine bats. Early in the evening, observed bats could be identified based upon their size and flight activity patterns (Gardner, 1978).

RESULTS AND DISCUSSION

Bat Trapping

From 29 June through 14 August, bats were trapped on the Big River and its tributaries between river kilometer 50 at Morse Mills and river kilometer 106 at Washington State Park. It was rare to find locations that met all four priorities of a good trap site. Thus, bats often were able to get around or over the mist nets once the net was detected. Comparisons of relative activity at a site, based on the ultrasonic monitors and capture data, indicated that bats usually were captured initially but would avoid the nets after release. Activity at the nets by the researchers also served to alarm bats in the area and probably contributed to bats becoming more aware of and avoiding the nets. However, there was no reason to believe that bats were not being captured in the relative proportions that they were occurring over the water. A total of fifty-five trap nights and four monitor nights on the Big River resulted in the capture of 393 bats of ten species (Table 2). The red bat (Lasiurus borealis) was the most common bat captured, comprising 55 percent of the total sample. This was followed by the eastern pipistrelle

bat (Pipistrellus subflavus) (17%) and the evening bat (Nycticieus humeralis) (15%). These three species together comprised 87% of the total sample. Comparison of captures over the main channel with those over tributaries (Table 3) indicated a much greater percentage of myotine bats and N. humeralis captured on tributaries relative to the other bats.

Of the myotine bats captured, there were two federal endangered species, M. sodalis and M. grisescens. They comprised 2.3% and 1.5% of the total sample respectively. The locations of their capture are listed in Table 4. Of the nine M. sodalis captured, only two were females. One female, captured on 1 July, was lactating, while the second female, captured on 22 July, was post-lactating. Of the six M. grisescens captured, only one was a female juvenile, captured on 12 August. From 29 June through 15 July, adult females of all species that were examined (N=12) had swollen teats and were lactating. On 7 July, a female P. subflavus was captured on the Mineral Fork tributary (Site #51) with a single young attached to its nipple. From 16 July through 30 July, six of the eight females that were examined were lactating while the remaining two were post-lactating. After 30 July, all adult females examined (N=16) were post lactating.

Table 2. Bat Species Captured Over the Big River and Its Tributaries in the Pine Ford Study Area, 29 June - 14 August, 1981.

SPECIES	NO. OF MALES CAPTURED	NO. OF FEMALES CAPTURED	NO. UNKNOWN	TOTAL	PERCENT OF ALL BATS CAPTURED
Myotis grisescens	5	1	0	6	1.5
M. sodalis	7	2	0	9	2.3
M. keenii	3	2	0	5	1.3
M. lucifugus	8	2	0	10	2.5
M. leibii	0	1	0	1	0.3
Lasiurus cinereus	2	2	0	4	1.0
L. borealis	85	89	42	216	55.0
Pipistrellus subflavus	25	33	9	67	17.0
Nycticeius humeralis	9	46	3	58	14.8
Eptesicus fuscus	13	2	2	17	4.3
TOTALS:	157	180	56	393	

Table 3. Comparison of Bat Captures Over the Main Channel of the Big River With Those Over Its Tributaries Within the Pine Ford Study Area.

GENUS	TOTAL NO. CAPTURED	PERCENT CAPTURED OVER MAIN CHANNEL	PERCENT CAPTURED OVER TRIBUTARIES
Myotis	31	64.5	35.5
Lasiurus	220	83.0	17.0
Pipistrellus	67	88.0	12.0
Nycticeius	58	63.0	37.0
Eptesicus	17	94.0	6.0

Table 4. Location and Dates of Capture of the Endangered Indiana Bat, Myotis sodalis and the Endangered Gray Bat, Myotis grisescens Over the Big River and Its Tributaries.

SPECIES	CAPTURE DATE	SEX[a]	AGE[b]	CAPTURE LOCATION[c]
Myotis sodalis	1 July 81	F[d]	A	Site 48R-Main channel-River kilometer 94
	1 July 81	M	A	Site 48R-Main channel-River kilometer 94
	1 July 81	M	A	Site 48R-Main channel-River kilometer 94
	10 July 81	M	A	Site 22R-Engel Ford Tributary-River kilometer 71
	22 July 81	F	A[e]	Site #7R-Bethlehem Creek-River kilometer 55
	30 July 81	M	A	Site #30-Grinnin Hollow Creek-River kilomter 79
	8 August 81	M	A	Site #31-Main channel-River kilometer 79
	9 August 81	M	A	Site #16-Main channel-River kilometer 65
	11 August 81	M	A	Site #20-Main channel-River kilometer 69
Myotis grisescens	29 June 81	M	A	Site #33-Main channel-River kilometer 81
	26 July 81	M	A	Site 35R-Calico Creek-River kilometer 82
	2 August 81	M	A	Site #34-Main channel-River kilometer 82
	12 August 81	M	A	Site 48R-Main channel-River kilometer 94
	12 August 81	M	A	Site 48R-Main channel-River kilometer 94
	12 August 81	F	J	Site 48R-Main channel-River kilometer 94

[a] M = male, F = female

[b] A = adult, J = juvenile

[c] Site numbers correspond to Figures 1 - 3 site locations

[d] Female was lactating at time of capture

[e] Female was post-lactation at time of capture

Examination of the mean capture times of the various species (Table 5) indicated a possibility of temporal resource partitioning between some species. Kunz (1973) showed significantly different foraging patterns between L. borealis and the hoary bat (L. cinereus) with L. borealis being characterized by the earliest feeding period (one - two hours after sunset) and L. cincereus characterized by a later feeding period (four - five hours after sunset). This was substantiated in this study. Kunz (1973) also found no significant temporal foraging activity among the big brown bat (Eptesicus fuscus) the little brown bat (M. lucifugus) and L. borealis. This also was found to be true during this study. A possible means of alleviating overlap in temporal foraging may be by developing spatial strategies to reduce competition for resources (Kunz, 1973). However, there appeared to be no consistent patterns regarding the location where particular species were caught in the nets. Thus, there was no indication of spatial partitioning based upon capture data.

On 14 August, one trap set and two monitor sets were worked on the Meramec River. Only one bat, L. borealis, was captured in the mist net. The monitor stations recorded extremely low levels of bat activity at other sites in this area.

Stream Characterization

The characteristics of bat trap sites on both the main channel and the tributaries are reported in Table 6. Overall, the tributaries were narrower and shallower than the main channel sites, with a lower canopy and much greater canopy cover over the water. Substrate characteristics of both were similar (Table 6). The tributaries showed much greater tunnel-like effects over the nets and more potential roost trees were present.

Table 5. Mean Capture Times for Bat Species Captured Over the Big River and Its Tributaries in the Pine Ford Study Area 29 June - 14 August, 1981.

SPECIES	SAMPLE SIZE[1]	MEAN CAPTURE TIME (CENTRAL DAYLIGHT TIME)
Myotis grisescens	6	2155
Pipistrellus subflavus	67	2220
Myotis sodalis	9	2224
Nycticeius humeralis	58	2224
Eptesicus fuscus	17	2234
Lasiurus borealis	208	2237
Myotis lucifugus	10	2244
Myotis keenii	5	2304
Lasiurus cinereus	4	2335
Myotis leibii [2]	1	----

[1] Sample sizes do not reflect total number of bats captured due to lack of data on escaped individuals.

[2] No mean capture time is recorded for Myotis leibii since only a single individual was captured.

Table 6. Stream Characteristics Around Bat Trap Sites for the Big River and Its Tributaries Within the Pine Ford Study Area.

	MAIN CHANNEL			TRIBUTARIES		
	Mean	Sample Size	Range	Mean	Sample Size	Range
Width (meters)	33.9	46	23.0- 55.0	11.8	8	6.10- 27.00
Depth (meters)	0.9	48	0.3- 3.0	0.3	8	0.87- 0.45
Percent canopy cover	33.0	44	0-100.0	89.0	8	40.00-100.00
Canopy height (meters)	21.2	40	15.0- 33.3	18.5	8	13.30- 31.70
Percent of times den trees present	6.5	46	----------	12.0	8	----------
Percent of times tunnel-like canopy cover over net	4.0 (total cover) 9.0 (partial cover)	46	----------	88.0 (total cover) 12.0 (partial cover)	8	----------
Percent of times for a particular substrate type	34.0 (gravel) 2.0 (sand) 64.0 (combination)	46	----------	50.0 (gravel) 50.0 (combination)	8	----------
Percent of times for a particular dominant tree size*	0.0 (Class 1) 2.2 (Class 2)	46	----------	0.0 (Class 1) 0.0 (Class 2)	8	----------

Table 6. Continued

	MAIN CHANNEL			TRIBUTARIES		
	Mean	Sample Size	Range	Mean	Sample Size	Range
Percent of times of a particular dominant tree size*	58.7 (Class 3) 39.1 (Class 4)			75.0 (Class 3) 25.0 (Class 4)		

* Class 1 = 0.0" to 4.9" dbh

Class 2 = 5.0" to 10.9" dbh

Class 3 = 11.0" to 15.9" dbh

Class 4 = 16.0" + dbh

Insect Trapping

As required by contract, two Johnson-Taylor suction traps were purchased for this study in order to determine temporal and spatial insect diversity and abundance at trap sites. However, due to their weight, size and fragile structure, they could not be transported on the river to the trap sites. Furthermore, the noise of the power generators needed to run the traps could affect the bats' behavior and thus trap success. Upon sonsultation with the project officer, this aspect of the study was not carried out. It was noted however, that high activity trap sites contained large number of mayflies. Futhermore, bat activity and capture times appeared to be correlated with the presence of mayfly hatches. This previously has been documented with the endanged M. grisescens in East Tennessee (Rabinowitz, 1979).

It is the suggestion of the author, as well as Dr. Merlin Tuttle (personal communication), that in the future, a study of this type should be carried out with sticky traps and/or blacklight traps. These traps are comparable in terms of insect trap success and can be correlated with bat activity (see Rabinowitz, 1979).

Discussion

The Big River and its tributaries within the Pine Ford Study Area have a rich and diverse bat fauna. All ten species that occur in the area during the summer months were captured. The overall bat capture rate, based upon numbers of bats captured per net night, was 7.0. This estimate is biased on the low side due to the difficulty of completely enclosing the river flyway with the mist nets on most occassions. This figure still is comparable to the 8.3 bats per net night reported by Cope et al. (1978) on the Big Blue River, which had the highest bat density of any river he had netted in Indiana. Calculation of species diversity using the Shannon-Wiener diversity index (Shannon and Wiener, 1963) gave a value of 1.97. Although the index value is influenced by sample size, it compares well with the figure of 1.62 obtained by Humphrey (1975) for Missouri. The fact that L. borealis was the most common species captured is in agreement with data obtained by LaVal and LaVal (1980) indicating that red bats are the most common species statewide. The large number of N. humeralis captured probably was related to the proximity of many trap sites to old farm buildings and barn structures. The large number of P. subflavus captured, probably was related to the abundance of rock cliff areas. However,

it must be considered that mist netting over streams yields a biased sample since those species that forage over streams more likely would be caught than those that just use streams as a flyway or only come to drink. Furthermore, species that are colonial may be absent in samples where nets are not erected in a colony's foraging area (LaVal and LaVal, 1980).

A relatively small number of endangered M. sodalis and M. grisescens were captured in the study area. Of those captured, all but three were adult males. Thus, there appeared to be no strong indications of M. sodalis maternity roost trees or M. grisescens maternity caves within the study area, based upon capture data. Male M. sodalis may stay in caves, mines or under bridges during the summer months (Barbour and Davis, 1969) and usually do not occur within the foraging ranges of the females (Humphrey et al., 1977). The single lactating female captured on 1 July and the single post-lactating female captured on 22 July, raise the possibility of maternity roosts. However, both areas of capture, which were 15 km apart, were subsequently retrapped and no M. sodalis of either sex was captured in these areas again. Furthermore, no juvenile M. sodalis were captured at any time during the study. A possible bias in this study, however, was the time of the summer that it was conducted. The optimum trap time would have been during late May through early

June when females were pregnant and young are nonvolant. During this time, foraging is restricted to riparian habitat. Later in the summer, feeding is extended to other solitary trees and forest edge on the floodplain (Humphrey et al., 1977). The lack of any adult female M. grisescens in our capture sample was not surprising since females are restricted to very specialized maternity caves during the summer months (Tuttle, 1975). Although male adult M. grisescens also use caves during the summer, they have a much broader tolerance at this time for a wide range of thermal conditions and often stay in transient bachelor roosts. Thus, they may occupy any number of small caves which would not be suitable for females (Tuttle, 1976). Furthermore, M. grisescens have a much more extensive foraging range than M. sodalis while occupying summer roosts. They have been known to fly as much as 17 km from their roost cave (LaVal et al., 1977). The only female M. grisescens in the sample was a juvenile netted 12 August. It would be difficult to assess a place of origin for this bat considering that it was captured in late summer. During August, most bat species undergo swarming behavior (Mohr, 1976; Cope and Humphrey, 1977) flying long distances to investigate possible winter quarters. Some of these distances have been known to equal 800 km (Mohr, 1976).

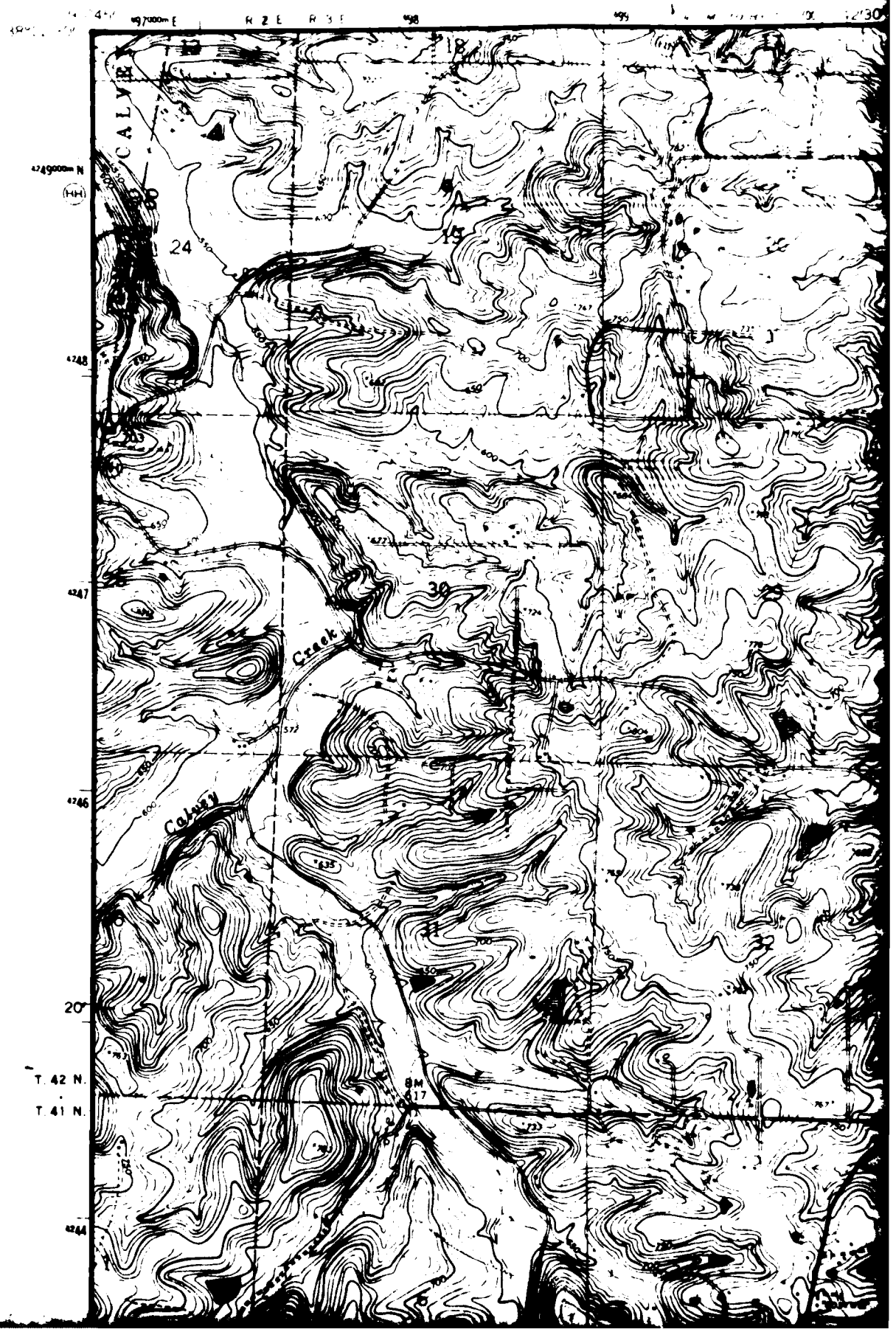
It also was important to compare the general riparian habitat characteristics on the Big River with those of other areas where M. sodalis maternity roosts have been located. Although this study area was similar in vegetation, canopy height and substrate characteristics to that found around the Knightstown, Indiana M. sodalis colony by Cope et al. (1978), it was not similar to the riparian habitat found around other colonies he located, nor was it very similar to that surveyed by Gardner and Gardner (1980). In addition, the main channel of the Big River was wider and deeper than that of any previous study where a colony had been located and there was a very low percentage of observed possible den trees.

The brief amount of time spent at the Meramec River sites allows no substantial conclusions to be drawn. However, the single trap night and two monitor nights indicated a poor habitat in terms of bat fauna. Activity levels and bat captures were extremely low and the substantial industrial and residential development in the area eliminates much of the possibility for good riparian habitat.

CONCLUSIONS

There appeared to be no M. sodalis or M. grisescens maternity colonies foraging or flying along the Big River or its tributaries within the defined boundries of the Pine Ford Study Area. However, the river within the study area is definitely used as a foraging site and flyway for males of both of these endangered species and possibly for occassional females from nearby colonies. Furthermore, the Big River has a relatively diverse and dense bat fauna and appears to be an important foraging area and/or flyway for adults and juveniles of many other bat species during the summer months.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



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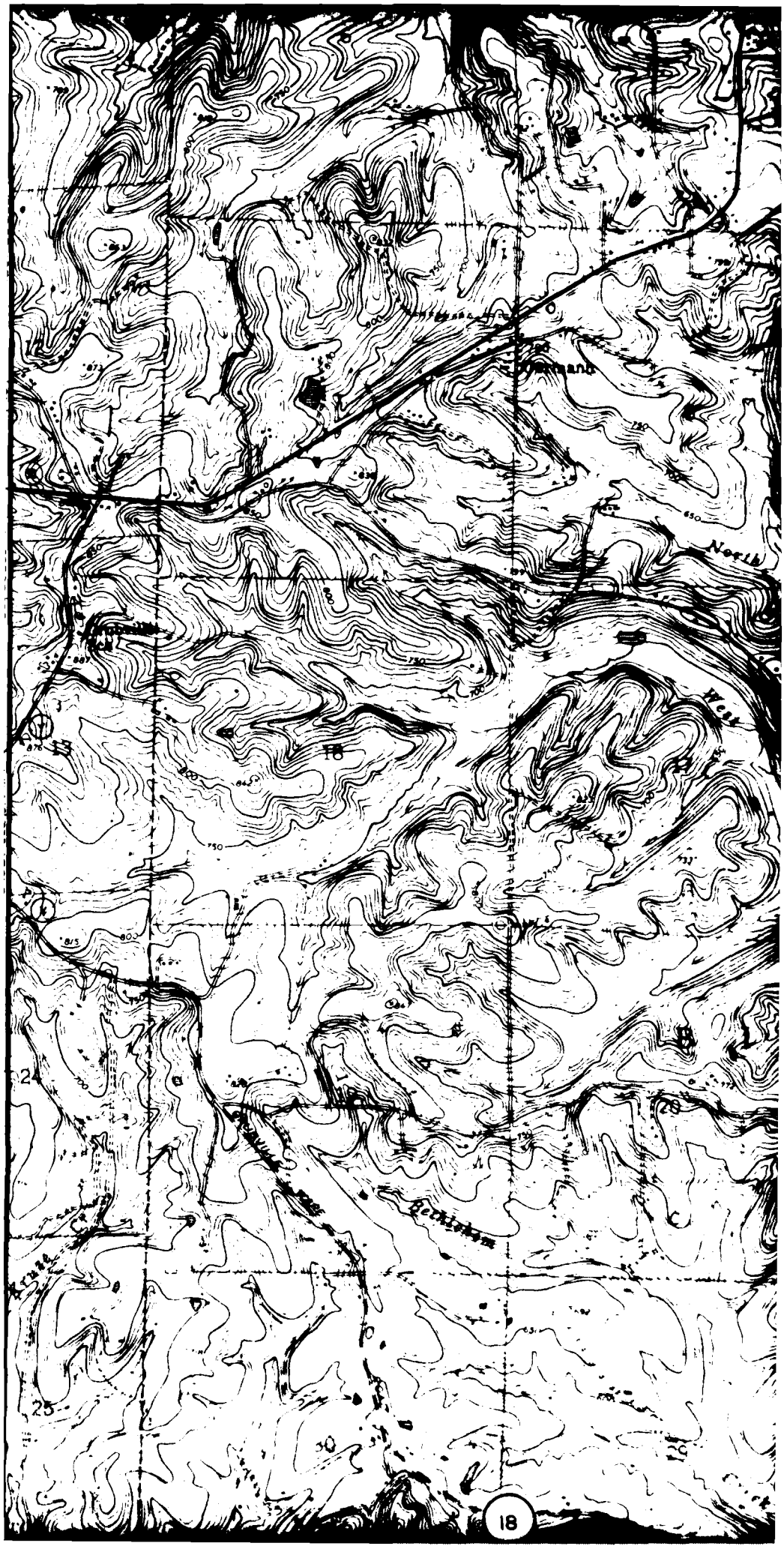
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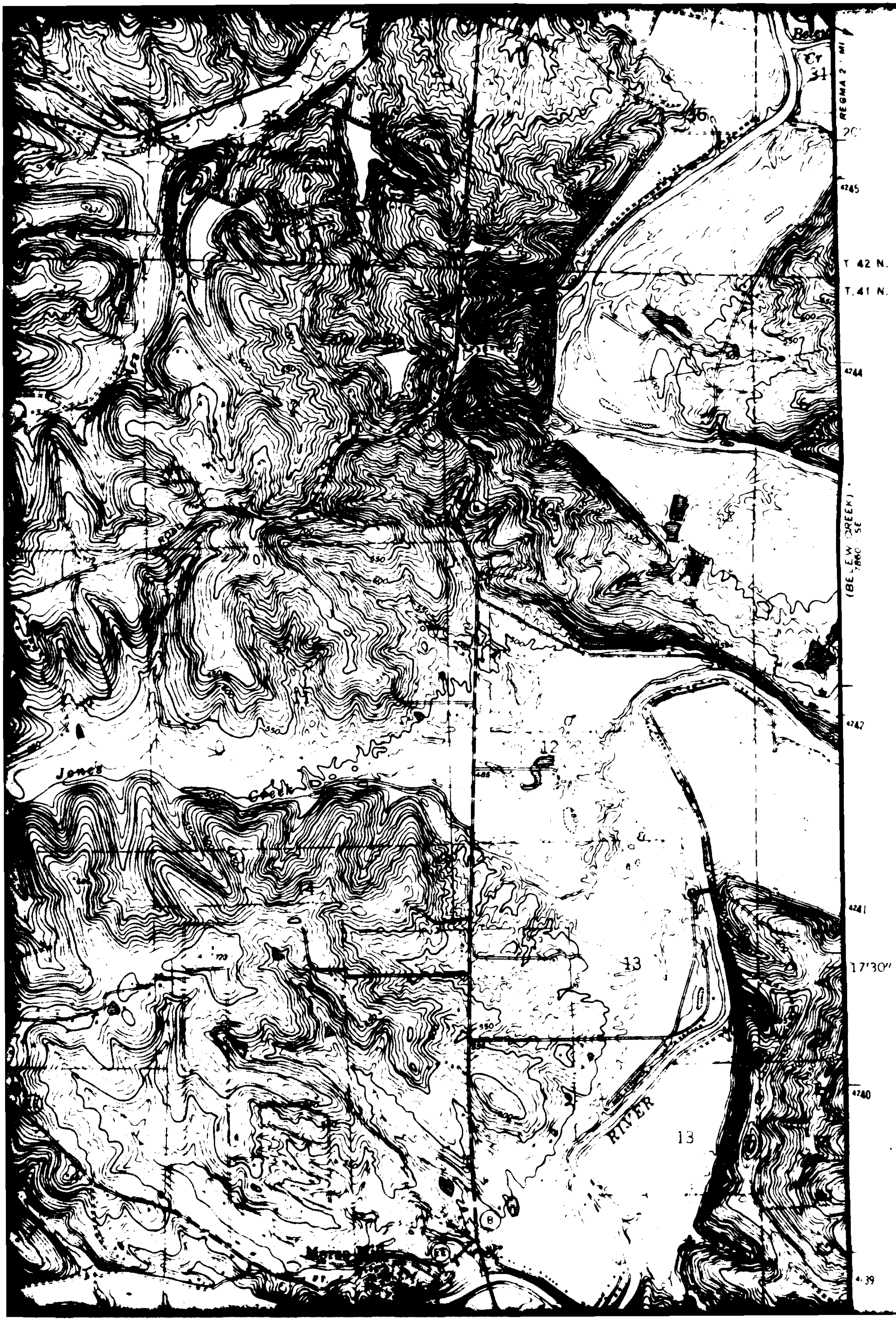
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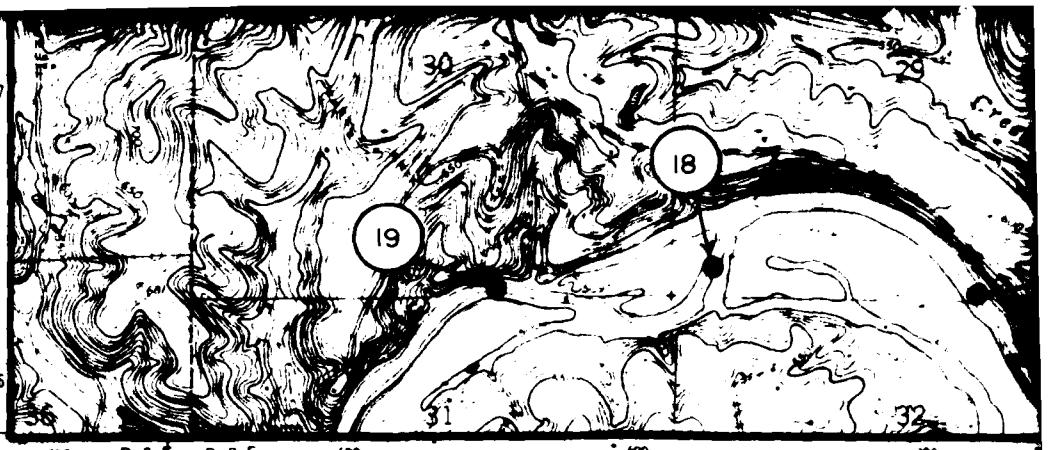


Mapped by the Army Map Service

Published for civil use by the Geological Survey

Control by USGS, USC&GS, and USCE

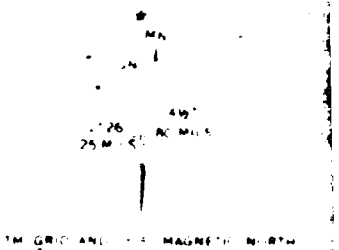
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952. Field check 1954

Polyconic projection. 1927 North American datum
10,000-foot grid based on Missouri coordinate system, east zone
1,000-meter Universal Transverse Mercator grid ticks, zone 15, shown in blue

Dashed land lines indicate approximate locations

Unchecked elevations are shown in brown

Revisions shown in purple compiled by the Geological Survey from aerial photographs taken 1968 and 1974. This information not field checked



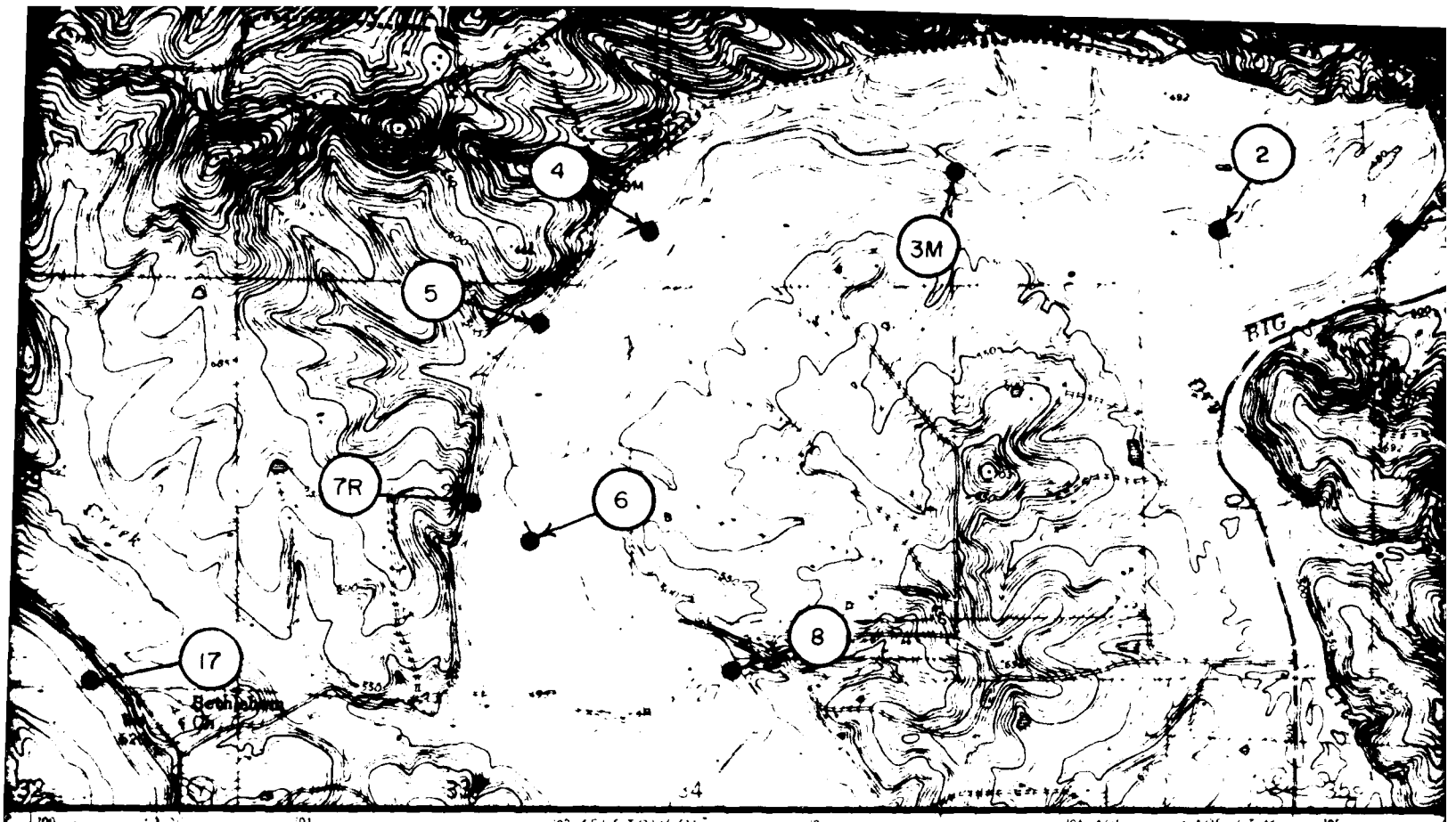
LEGEND

TRAP SITE NUMBER AND LOCATION

NO

PREPARED BY:

KENWILL, INC.
P.O. BOX 450
JACKSBORO, TN. 37757



NOTES:

1. SITE NUMBERS DO NOT CORRESPOND TO THE ORDER IN WHICH SITES W NUMBERED CONSECUTIVELY FOR EASE OF REFERENCE WITHIN TEXT.
2. THE M NUMBERS REFER TO SITES THAT WERE ONLY MONITORED A
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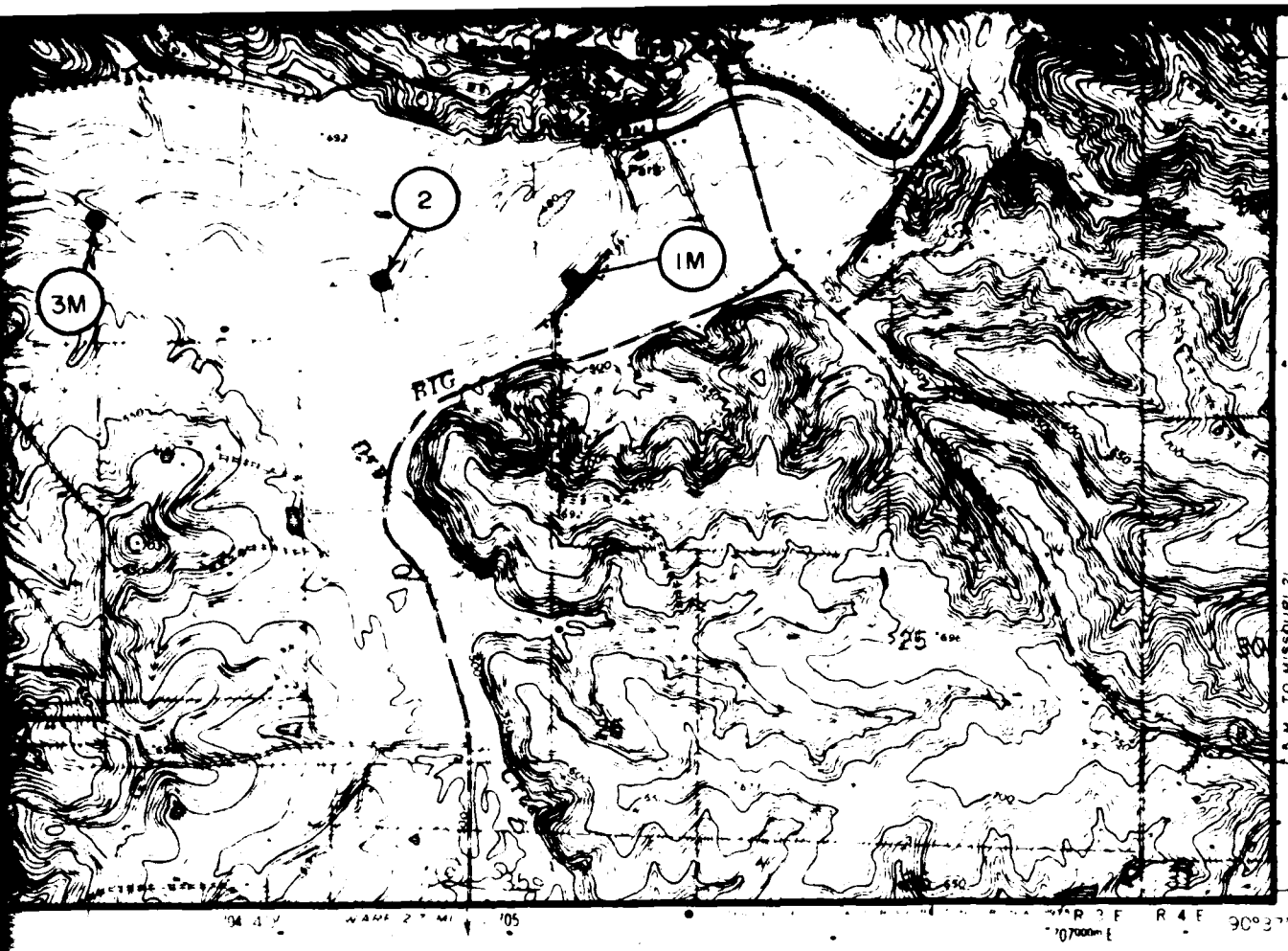

ROAD CLASSIFICATION

Heavy duty — Light duty

Medium duty — Unimproved dirt

State Route

MISSOURI

QUADRANGLE LOCATION

RDS
TON VIRGINIA 22092
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N REQUEST

CEDAR HILL, MO

N3815—W9037.5/7.5

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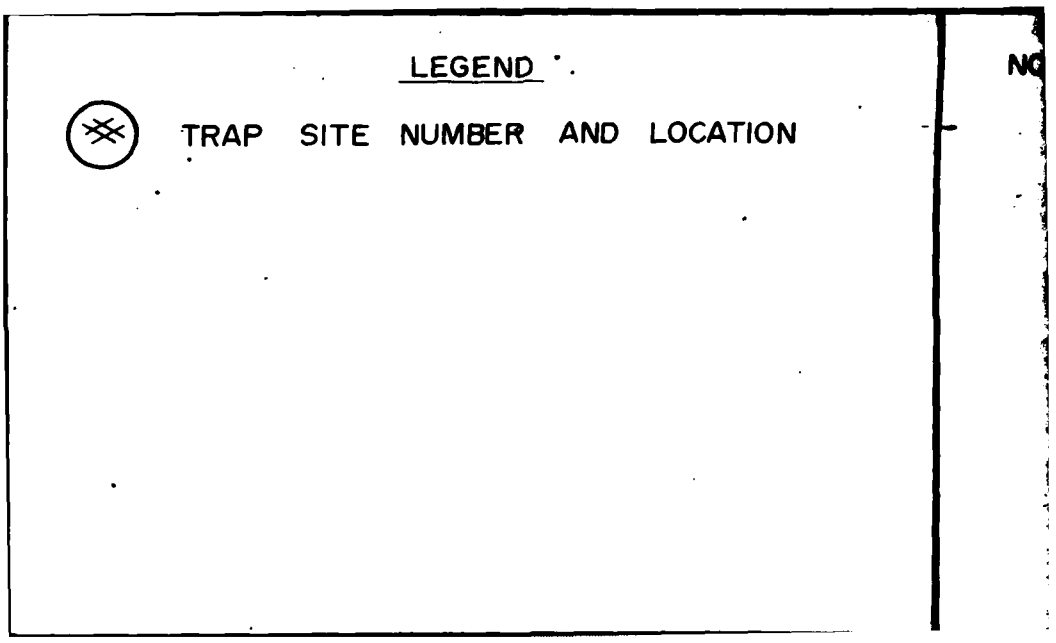
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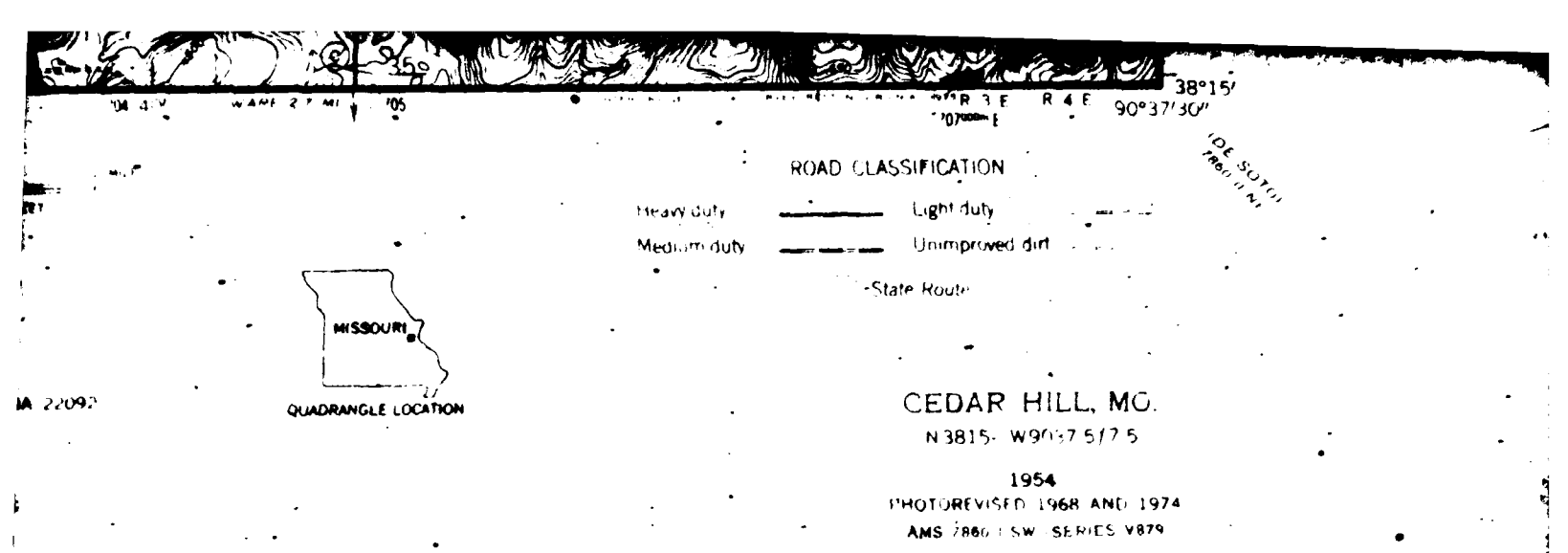

HE ORDER IN WHICH SITES WERE TRAPPED. THEY ARE
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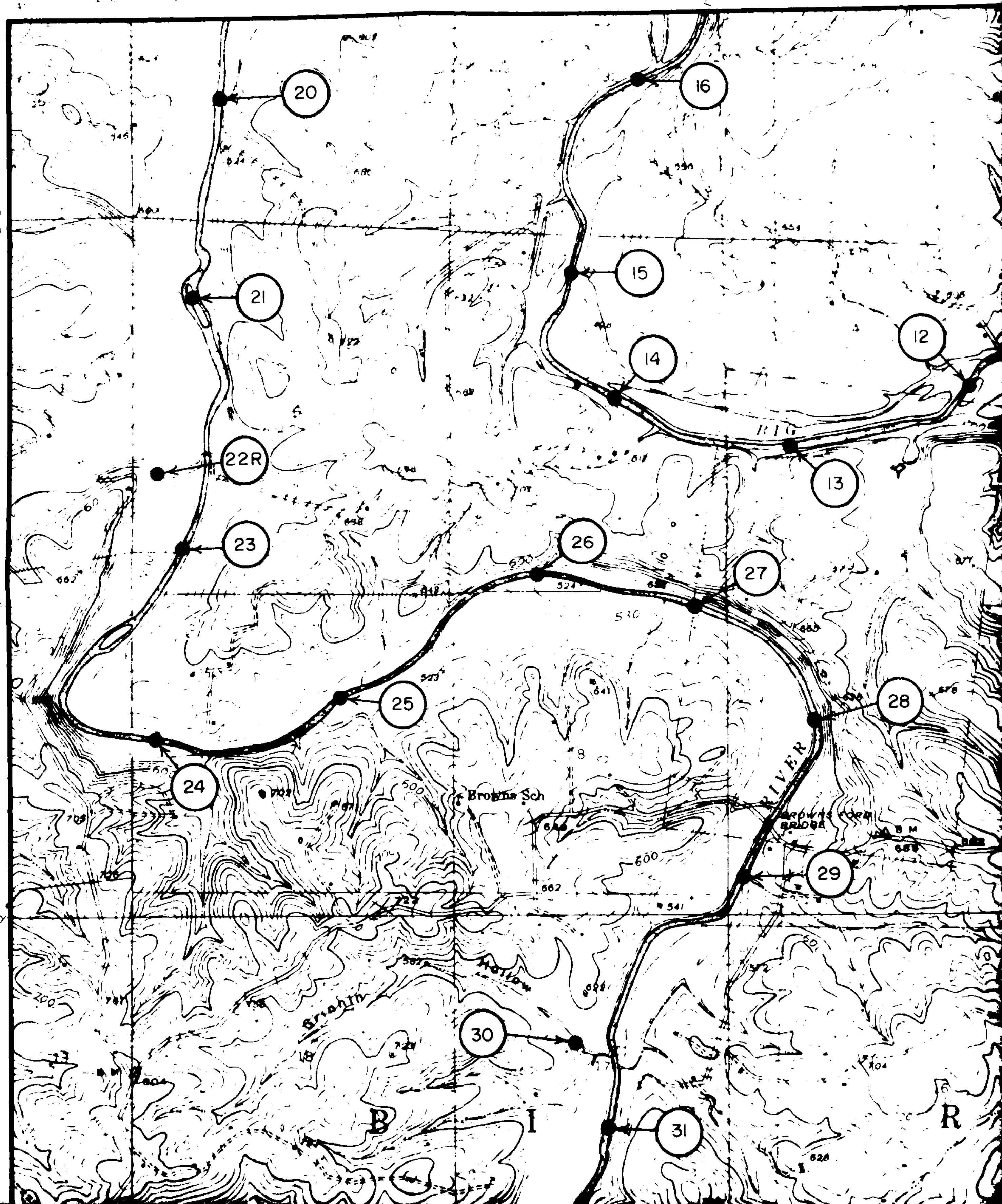
FIGURE:

1. TRAP SITES LOCATED WITHIN THE NORTHERN PORTION OF THE PINE FORD STUDY AREA.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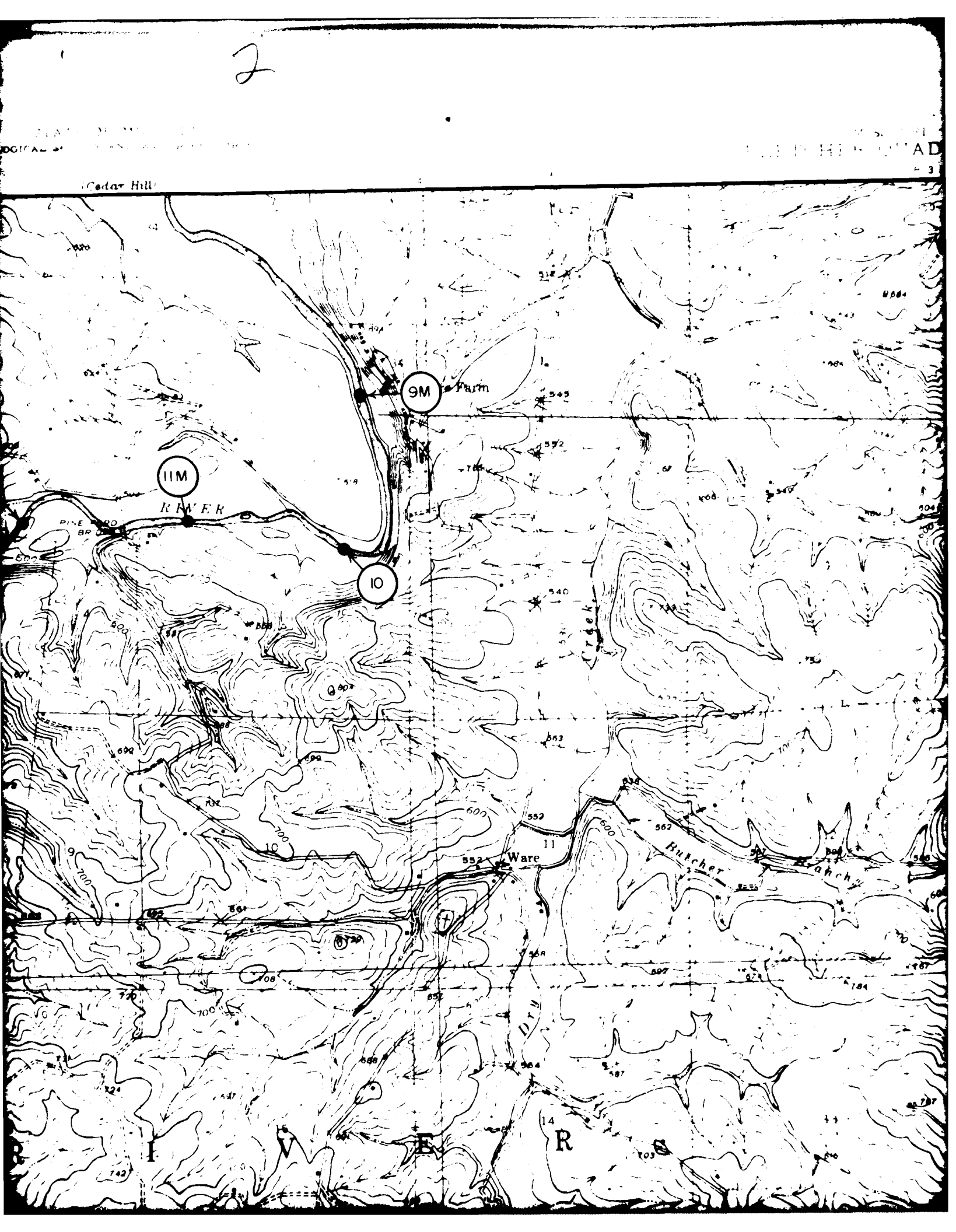
Cedar Hill
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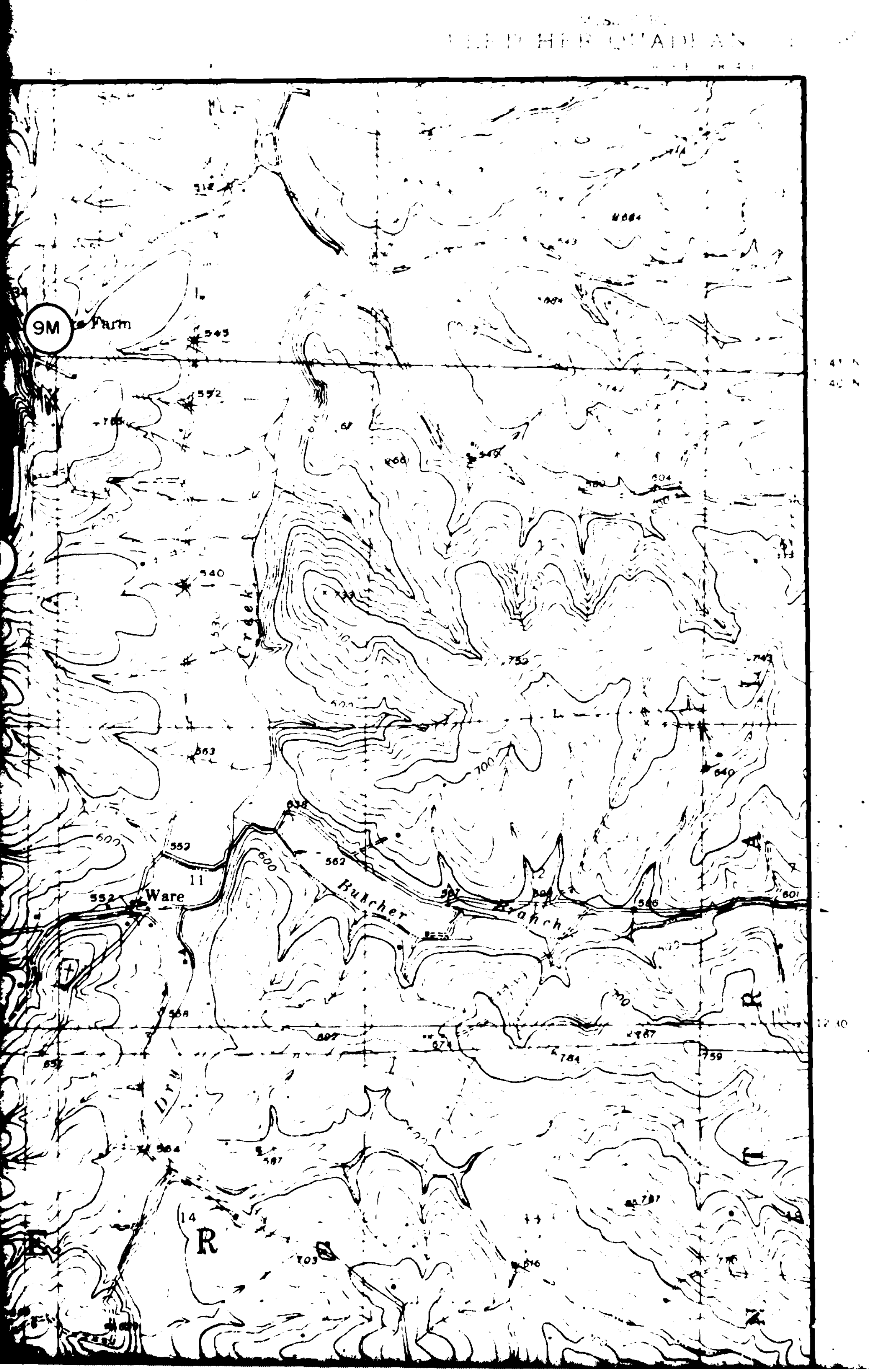
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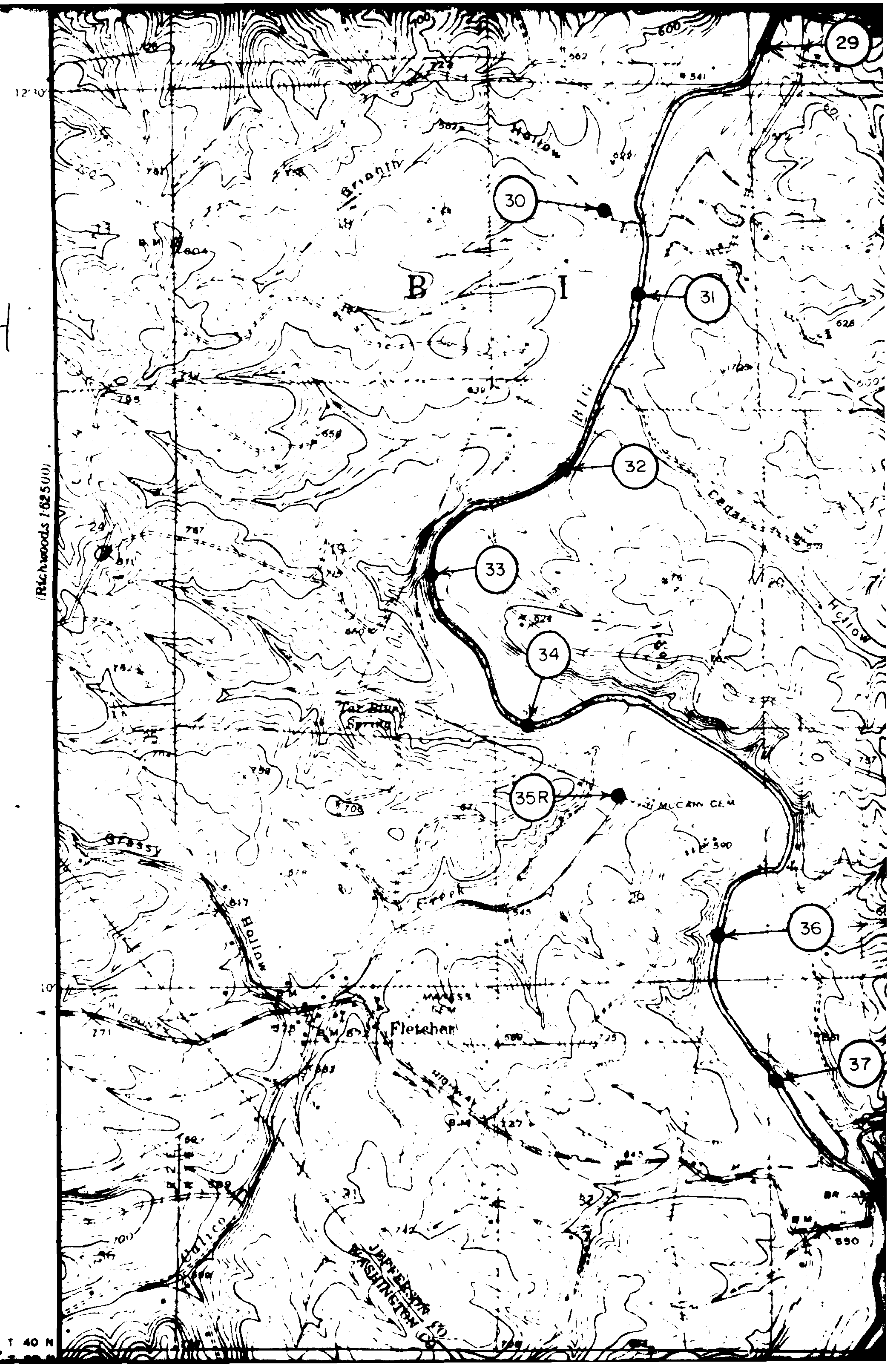

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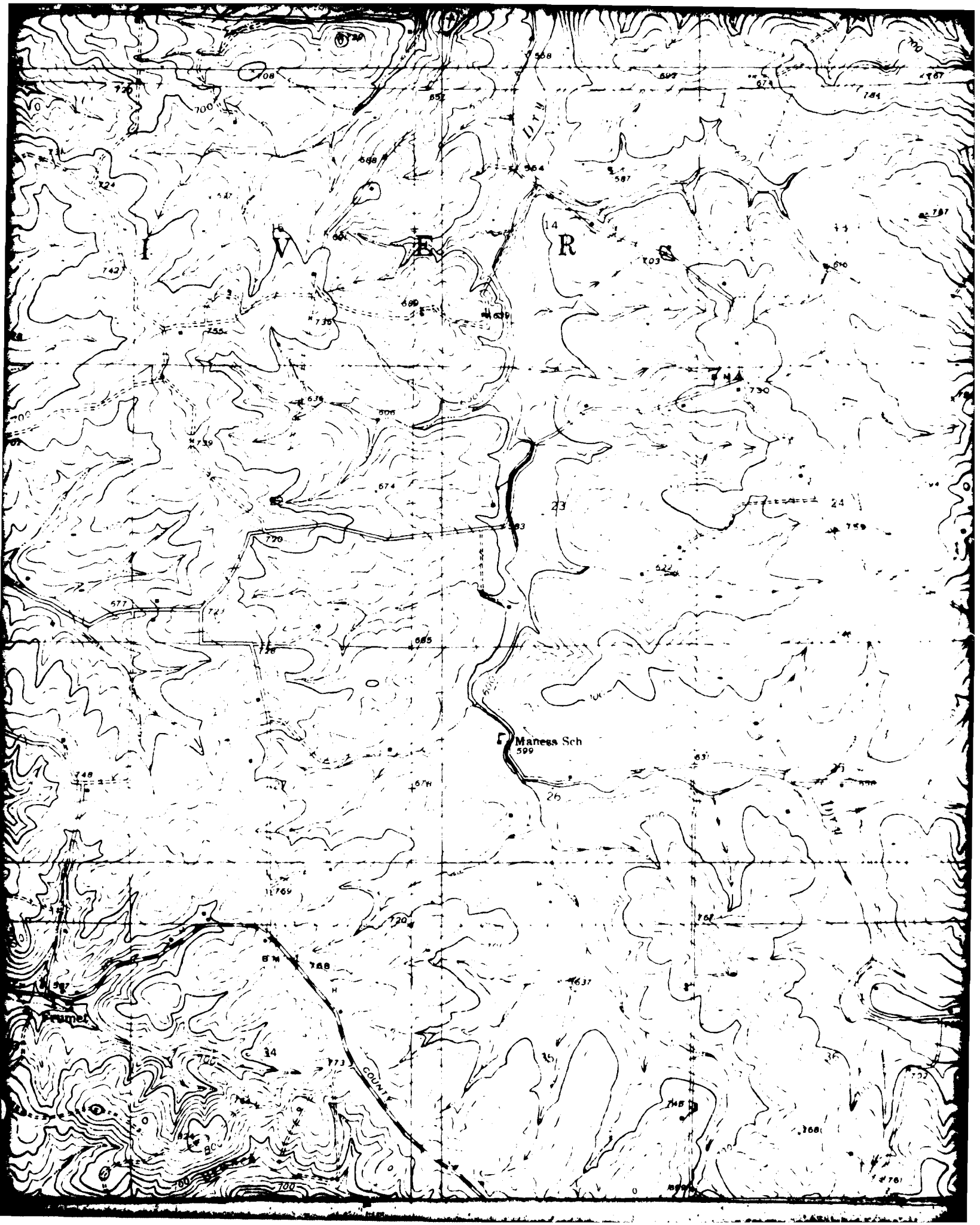
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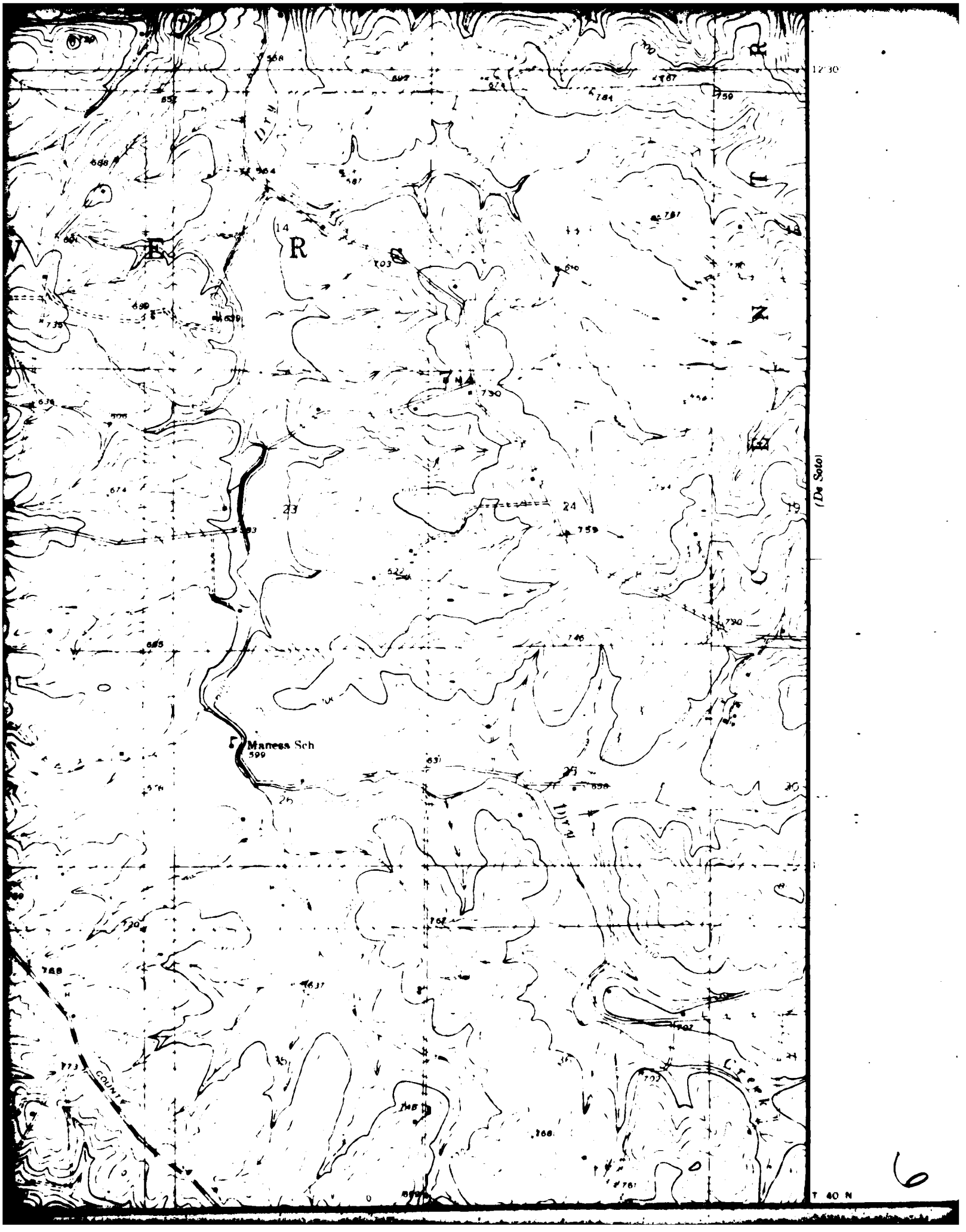
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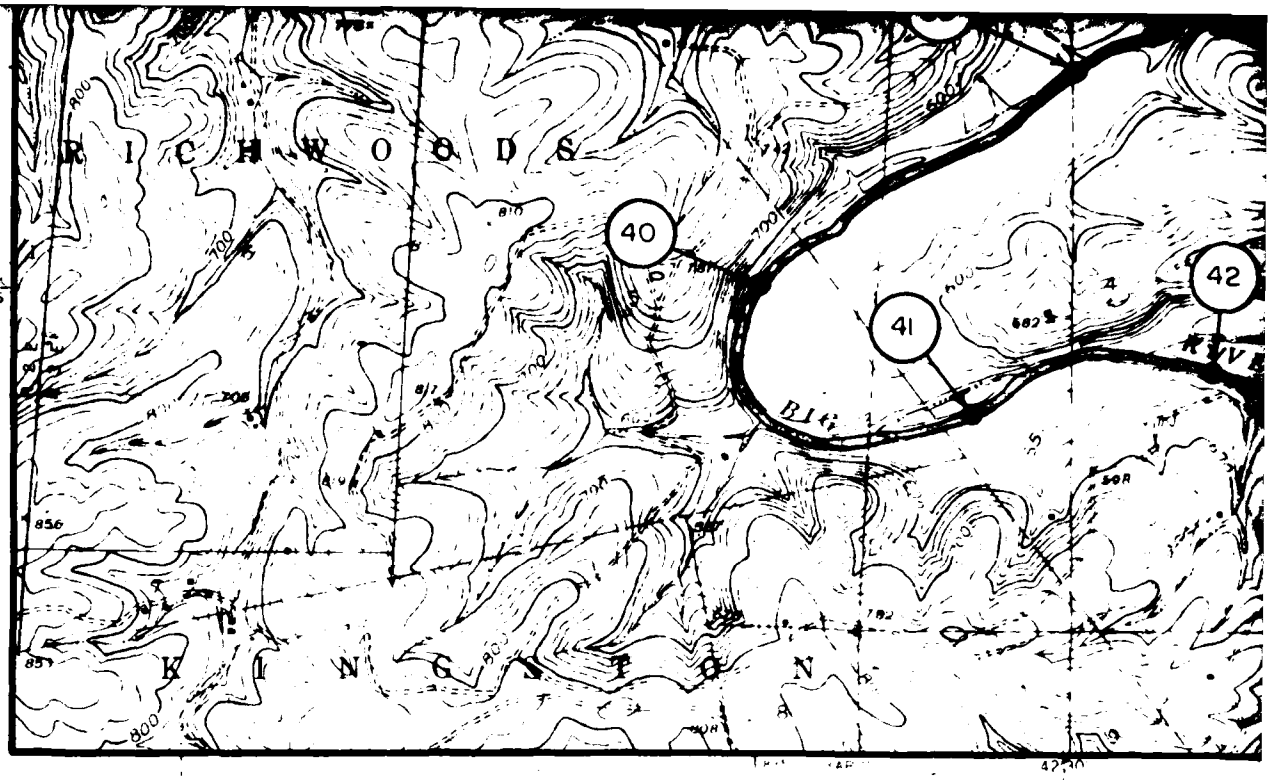

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Richwoods
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Glenn S. Smith, Division Engineer

Topography by [illegible]

Surveyed in [illegible]

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⊗ TRAP SITE NUMBER AND LOCATION

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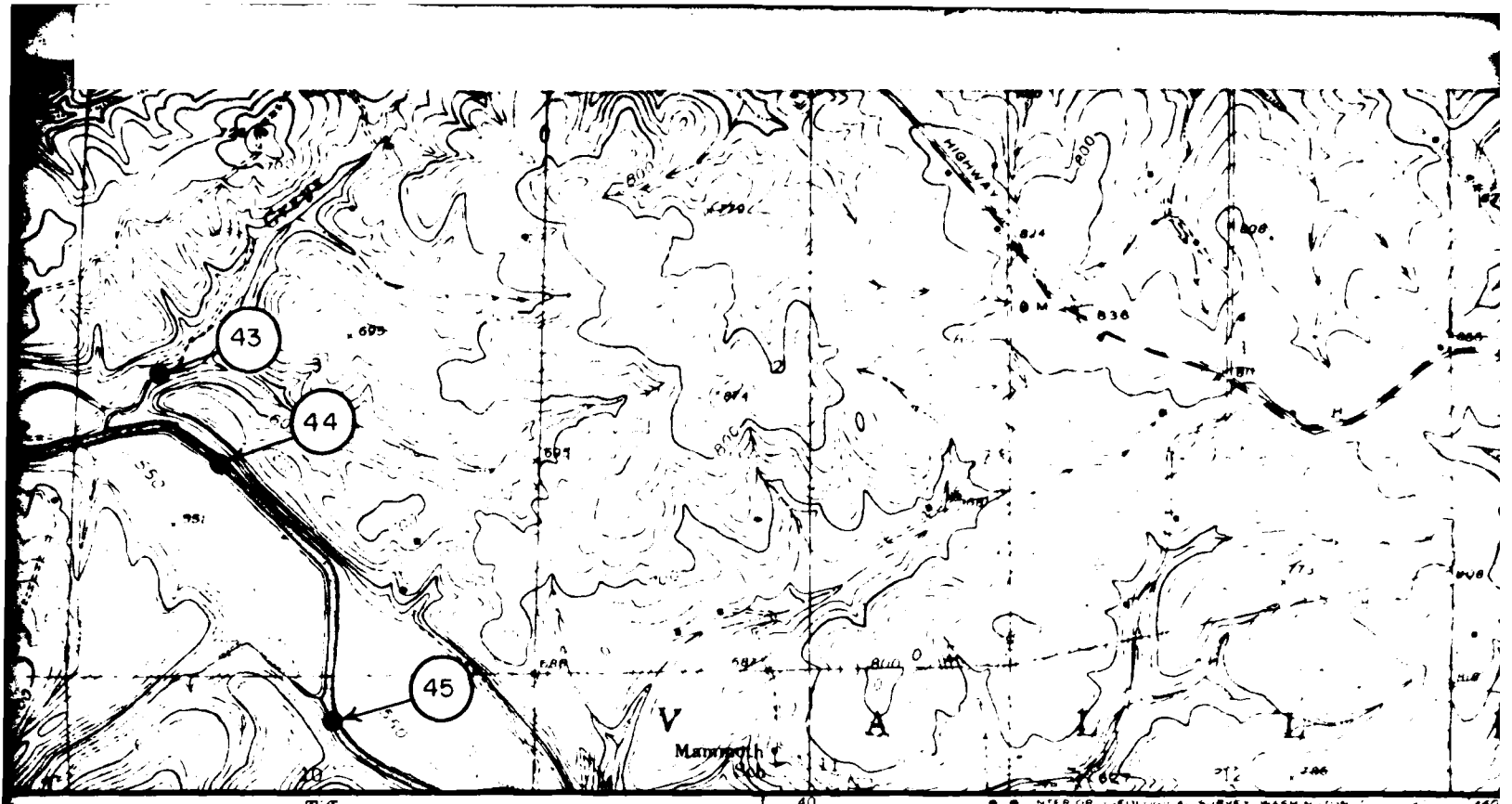

SCALE 1:24000

Contour interval 20 feet
10 foot contours added in dashed lines
Datum is mean sea level

TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN
DECLINATION

GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR WASHINGTON, D. C. 20242
BY THE MISSOURI GEOLOGICAL SURVEY, ROLLA, MISSOURI 65401
R DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

TE NUMBERS DO NOT CORRESPOND TO THE ORDER IN WHICH SITES WERE TRAPPED. THEY MBERED CONSECUTIVELY FOR EASE OF REFERENCE WITHIN TEXT.

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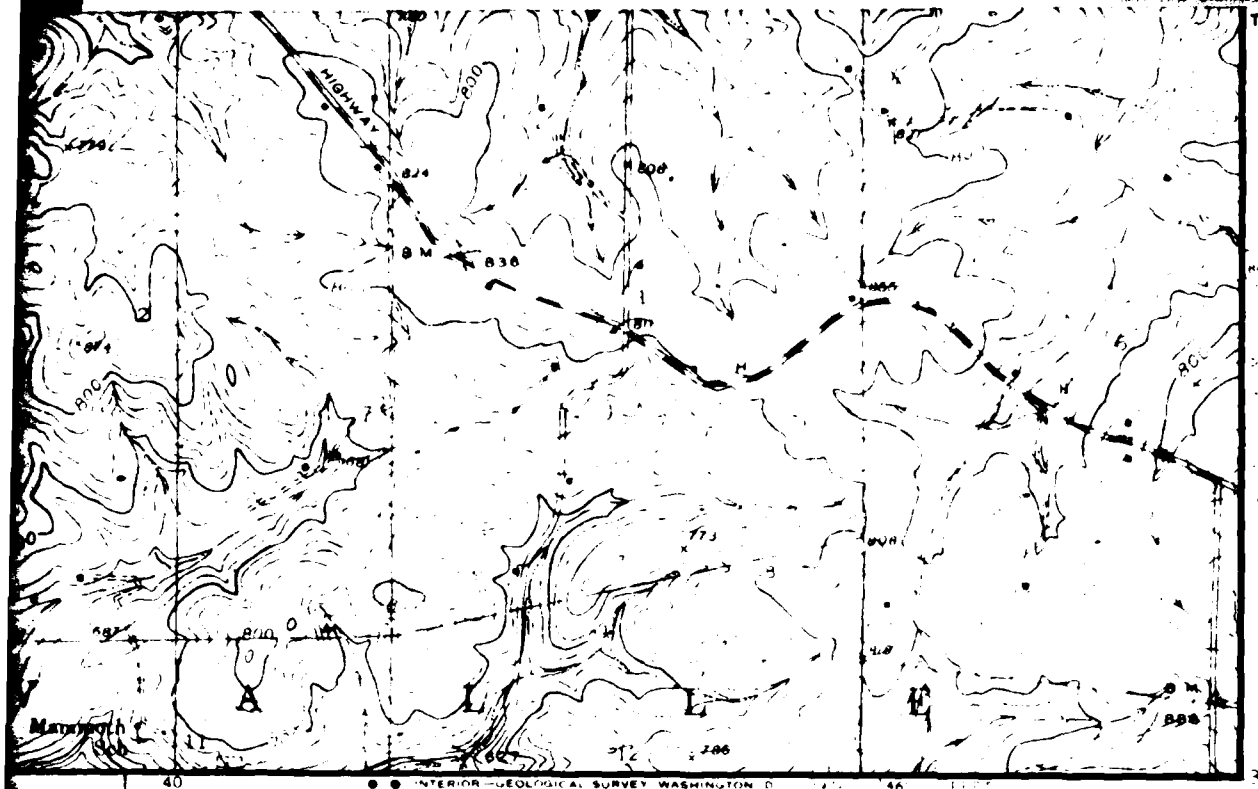

APPROXIMATE MEAN
DECLINATION,

FLETCHER, MO

N3807.5—W9037.5 7.5

1937

ON, D. C 20242

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HE ORDER IN WHICH SITES WERE TRAPPED. THEY ARE
REFERENCE WITHIN TEXT.

WERE ONLY MONITORED AND NOT TRAPPED.

WERE TRAPPED TWICE DUE TO PREVIOUS CAPTURE OF

Richwoods 1625(NW)

LEGEND

TRAP SITE NUMBER AND LOCATION

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PREPARED BY:

KENWILL, INC.
P.O. BOX 450
JACKSBORO, TN. 37757

UNDER DOD CONTRACT DACW 43-81-C-0

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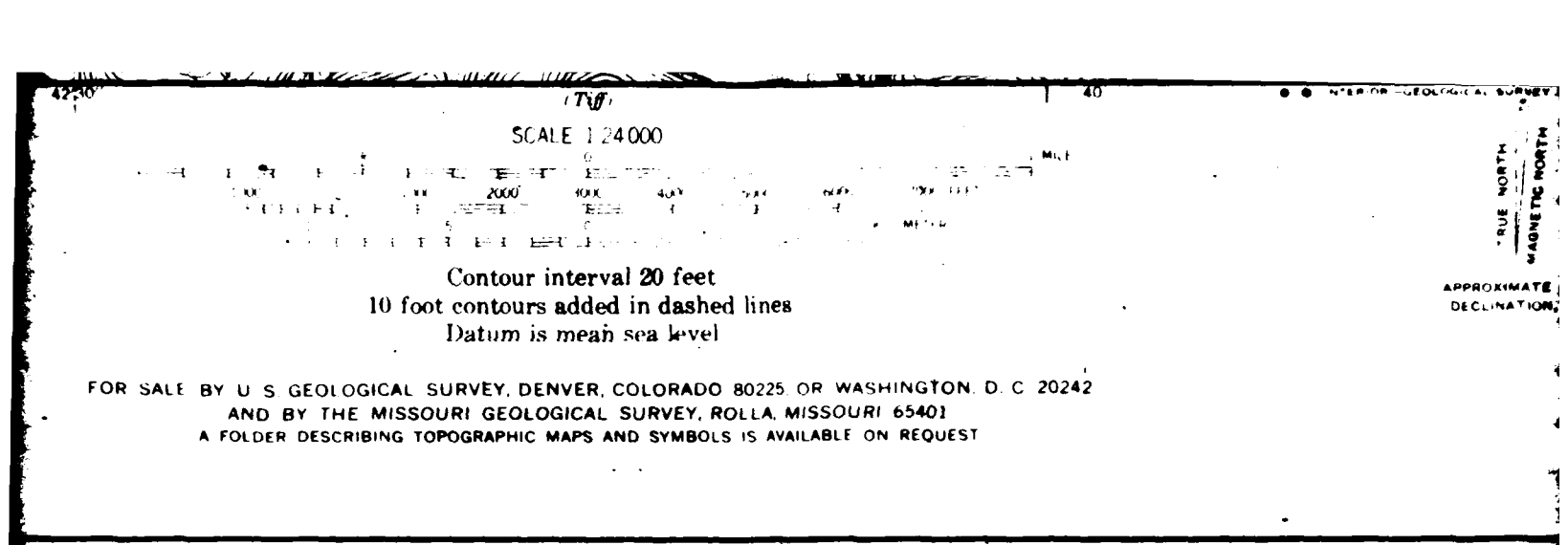

Contour interval 20 feet
10 foot contours added in dashed lines
Datum is mean sea level

FOR SALE BY U S GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR WASHINGTON, D. C 20242
AND BY THE MISSOURI GEOLOGICAL SURVEY, ROLLA, MISSOURI 65401
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

NOTES:

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2. THE M NUMBERS REFER TO SITES THAT WERE ONLY MONITORED AND NOT
3. THE R NUMBERS REFER TO SITES THAT WERE TRAPPED TWICE DUE TO P ENDANGERED SPECIES.

FIGURE:

2. TRAP SITES LOC PORTION OF TH

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APPROXIMATE MEAN
DECLINATION, 1937

Polyconic projection. 1927 North American datum

(Vineland)

FLETCHER, MO

N3807.5—W9037.5

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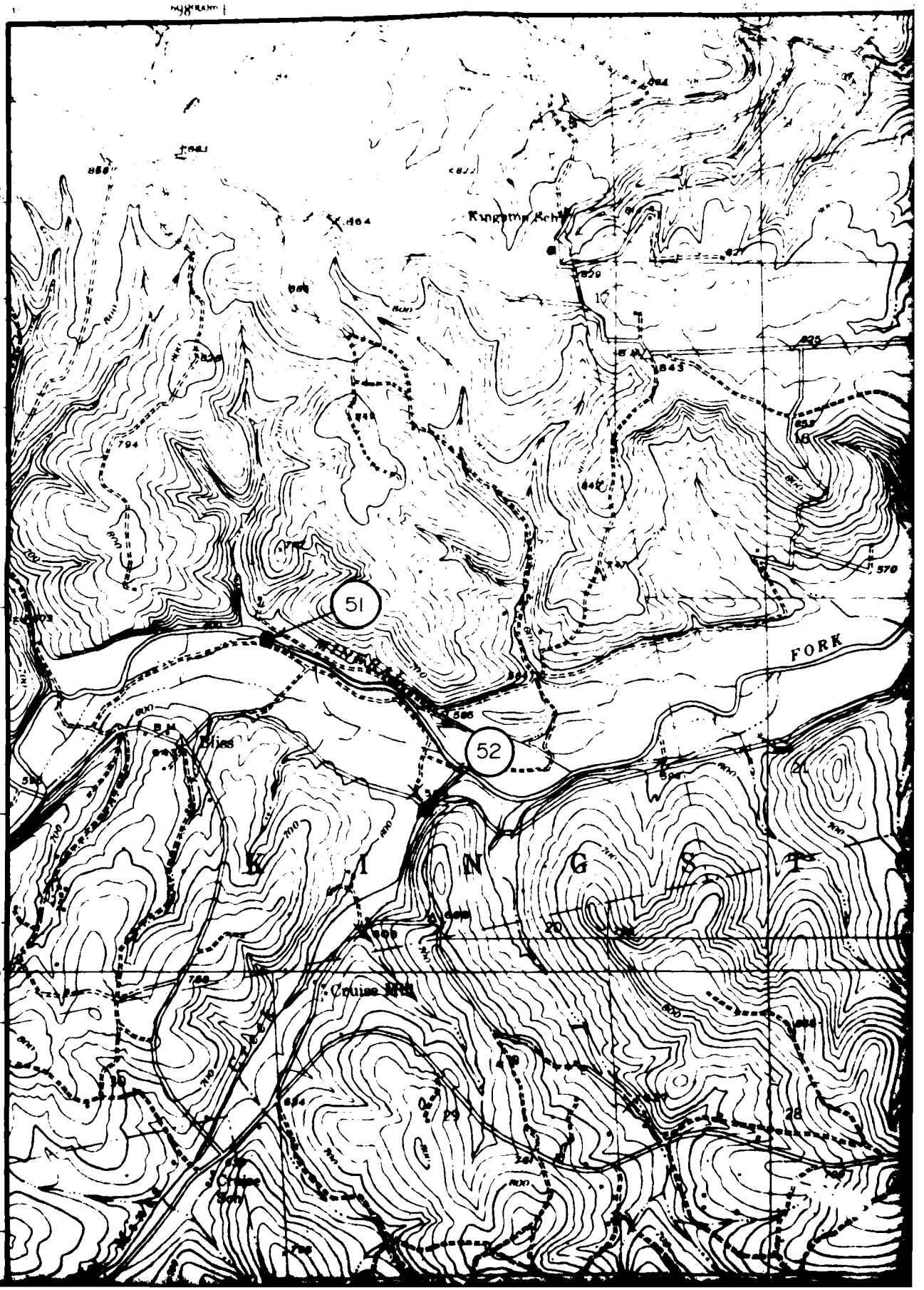
FIGURE:

2. TRAP SITES LOCATED WITHIN THE CENTRAL PORTION OF THE PINE FORD STUDY AREA.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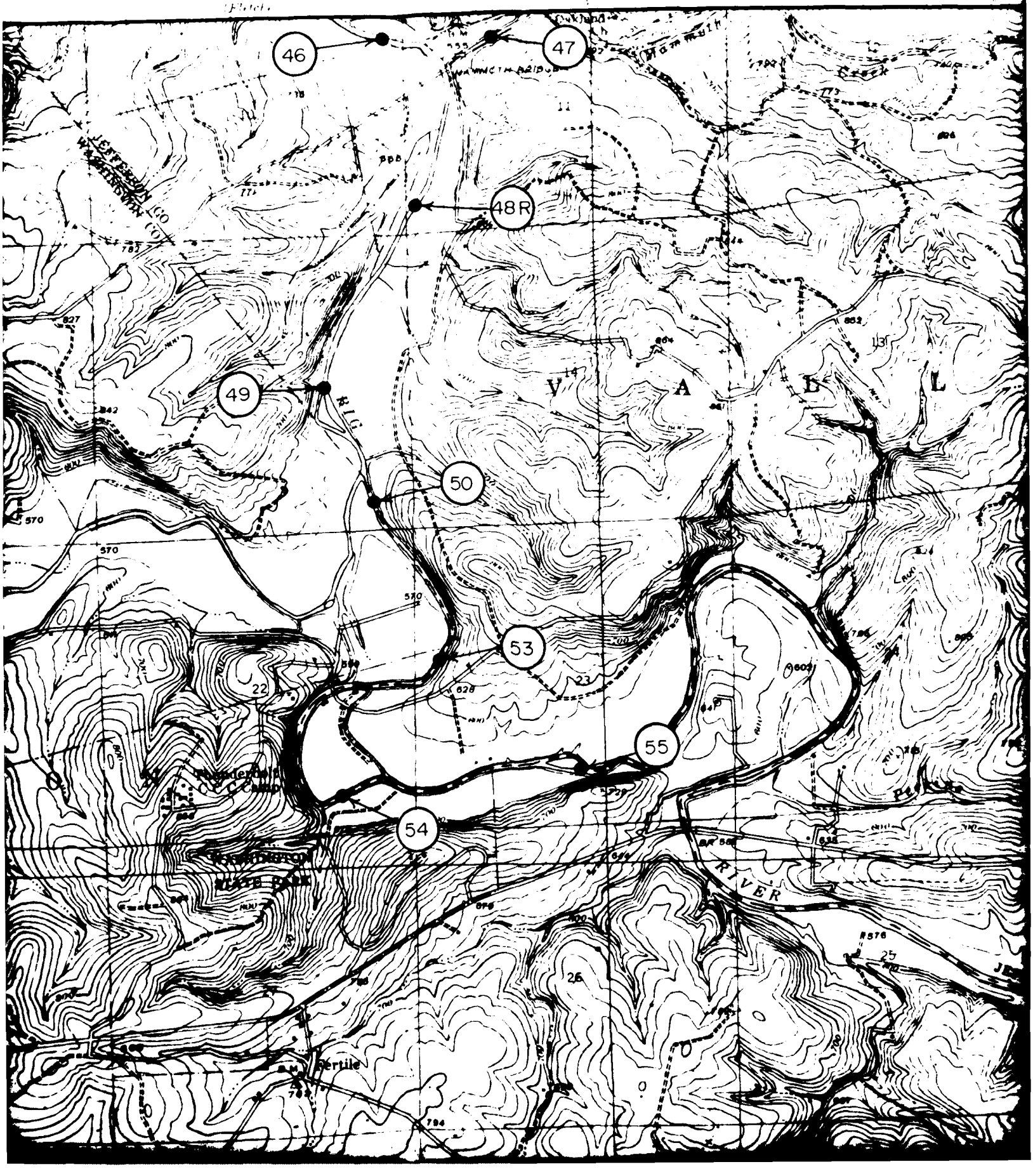

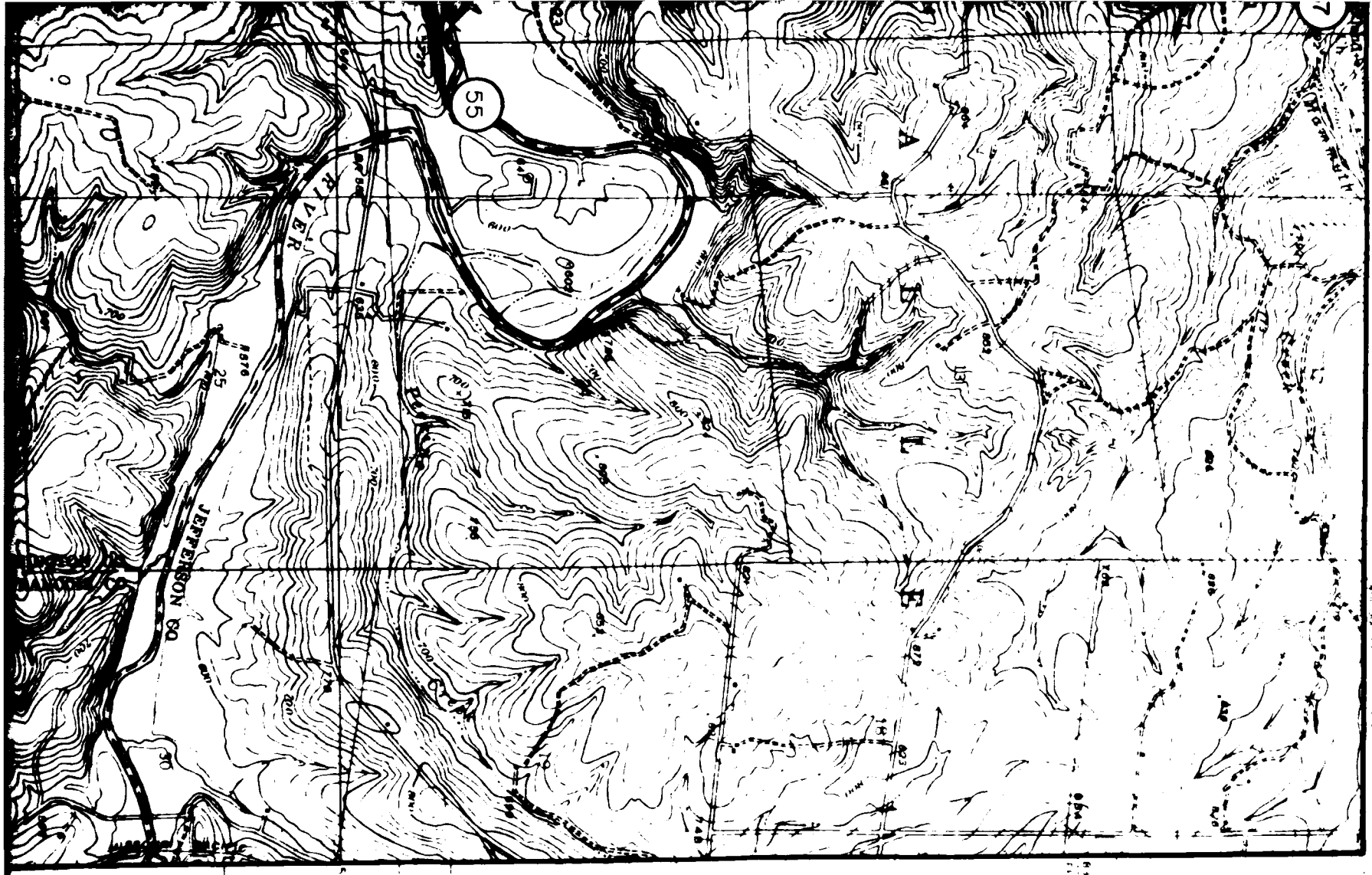

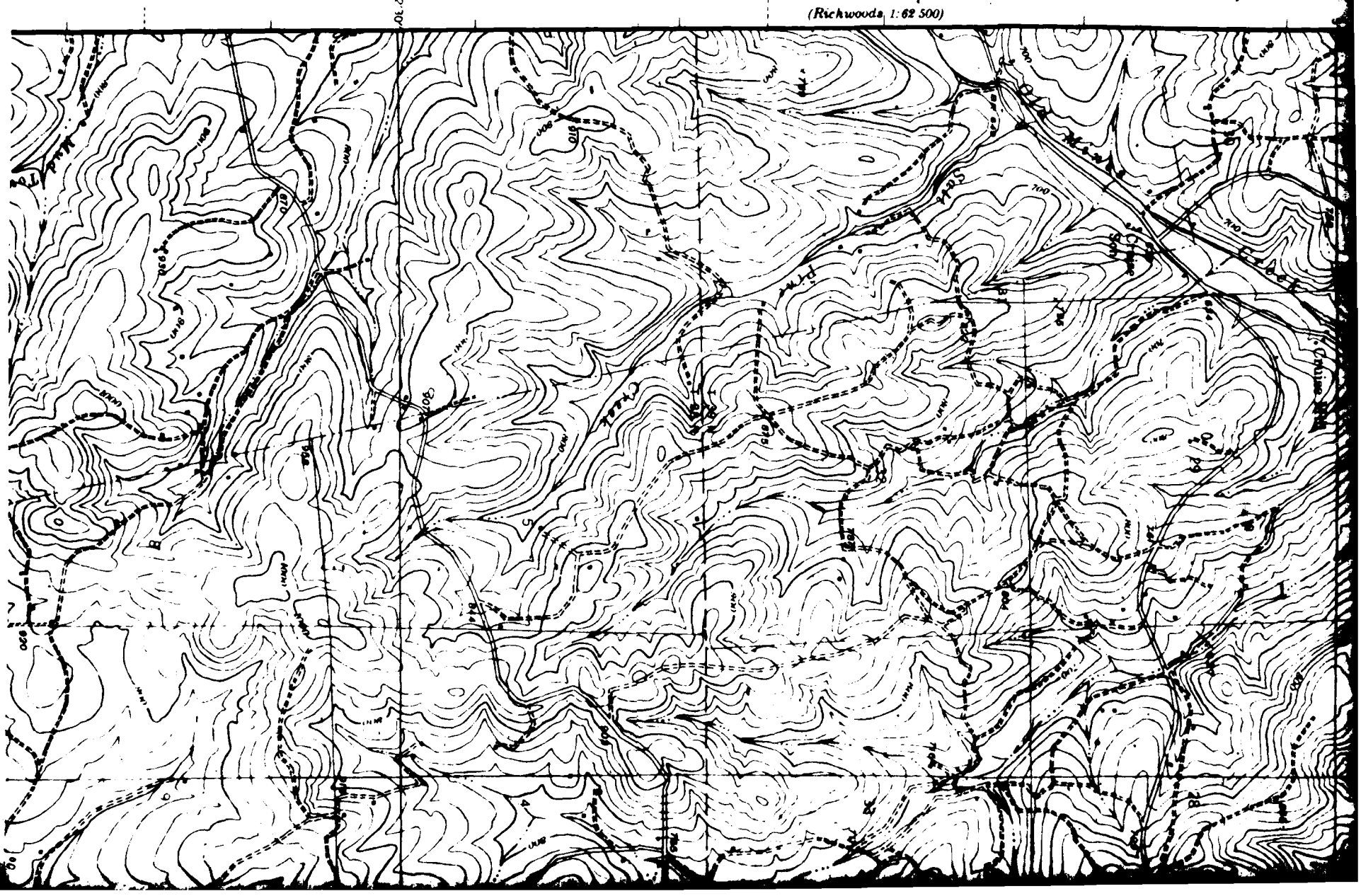
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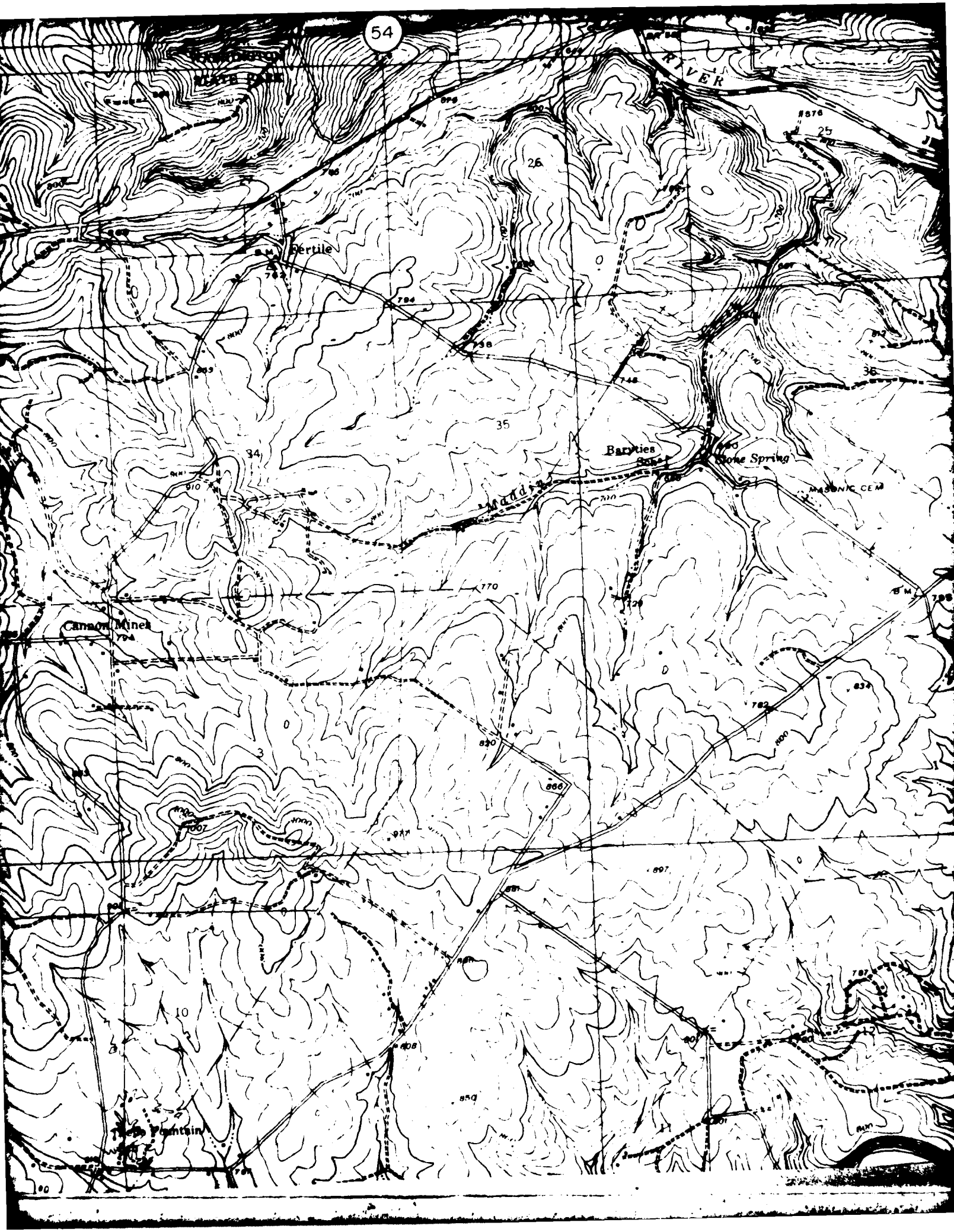
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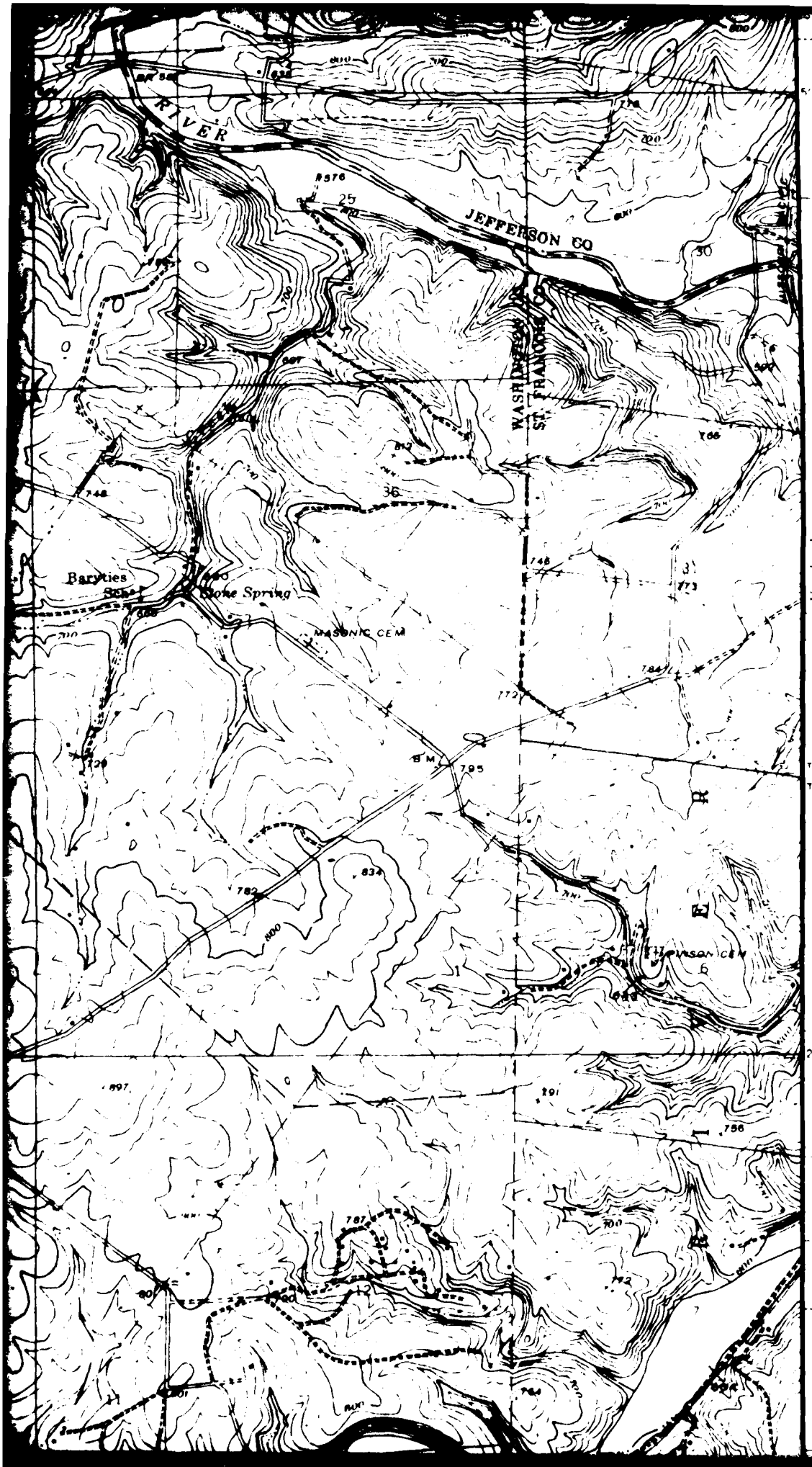
RIVER
JEFFERSON CO
WASHINGTON CO
ST. FRANCOIS CO
Baryties
Store
Stone Spring
MASONIC CEM
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(Vineland)

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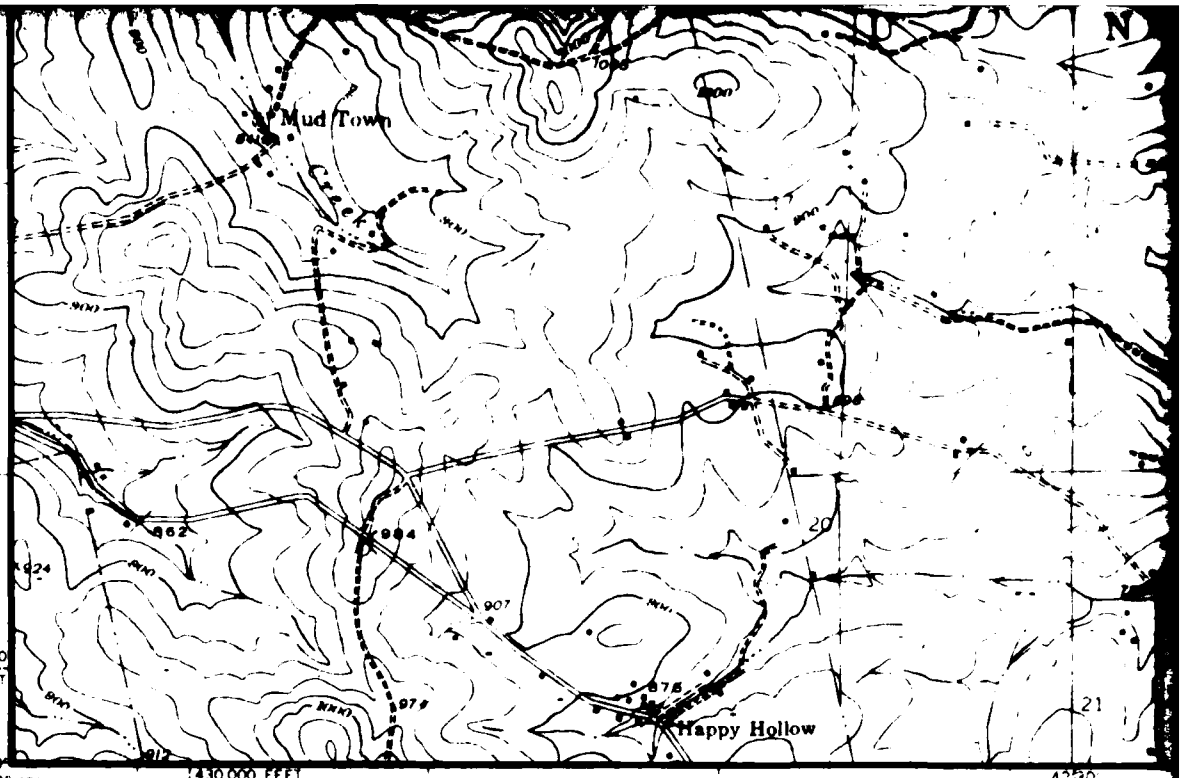


(Potosi)

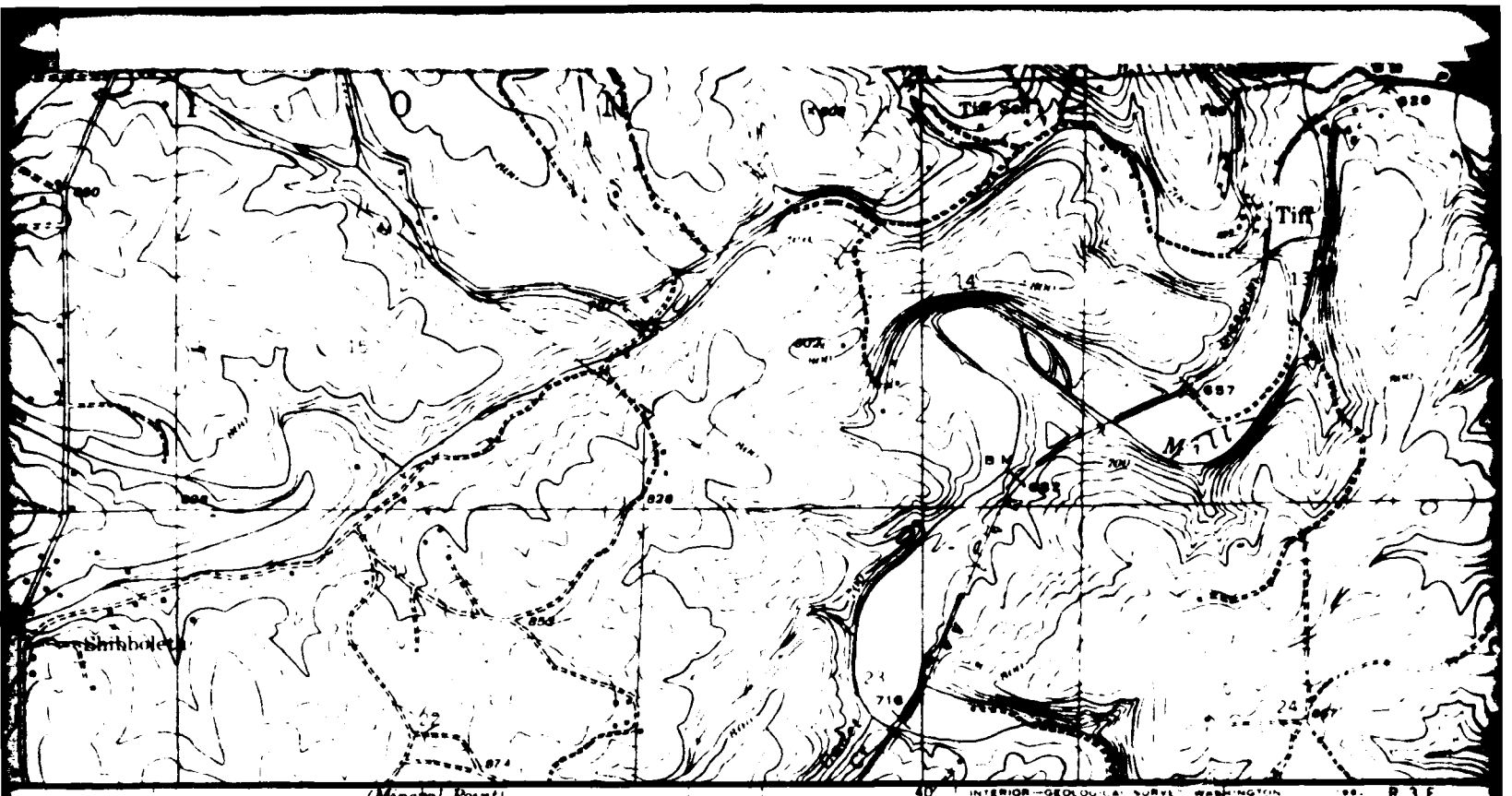
Glenn S. Smith, Division Engineer
Topography by T. V. Cummins and Elmer Fishire
Surveyed in 1937

FOR

LEGEND

⊗ TRAP SITE NUMBER AND LOCATION

NOTES:



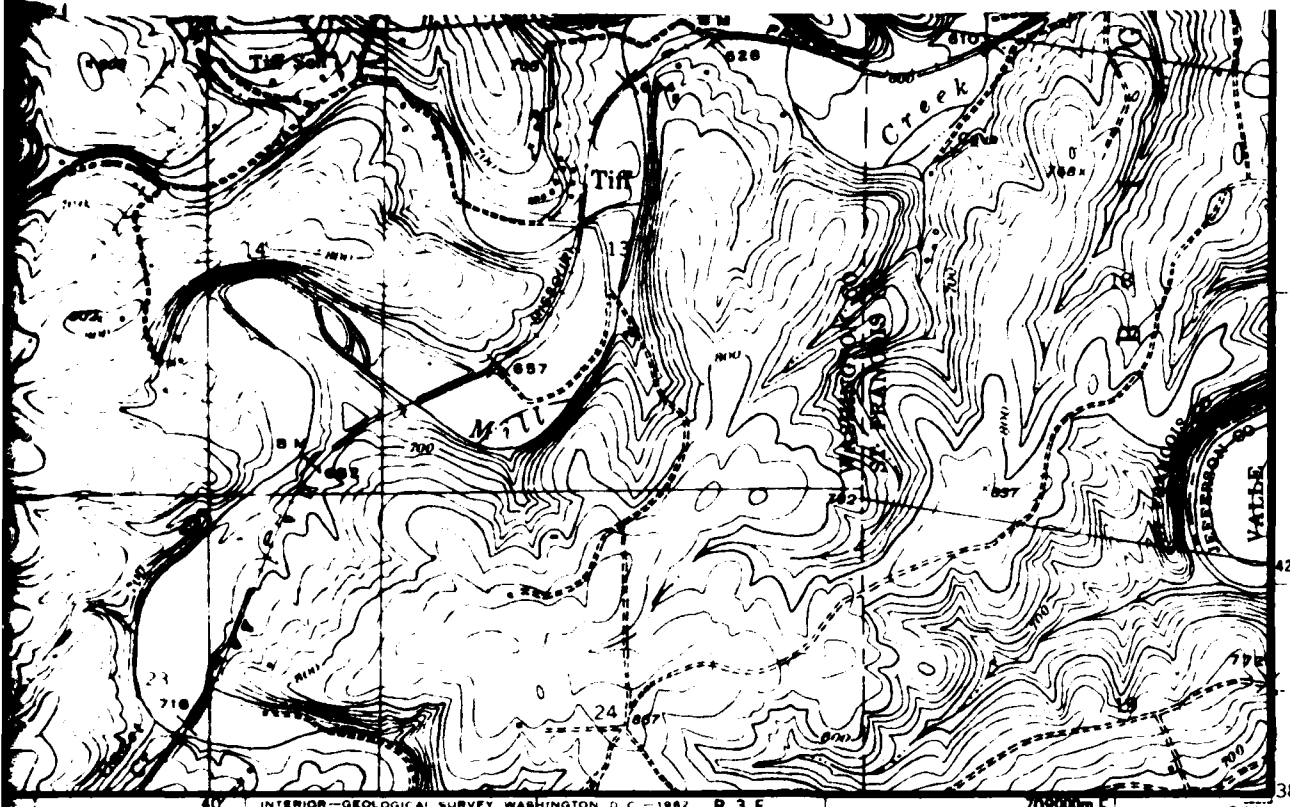
SCALE 1:24 000

Contour interval 20 feet
Datum is mean sea level

TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN
DECLINATION 19

SALE BY U S GEOLOGICAL SURVEY DENVER 25 COLORADO OR WASHINGTON 25 D C.
AND BY THE MISSOURI GEOLOGICAL SURVEY, ROLLA, MISSOURI
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



INTERIOR—GEOLOGICAL SURVEY WASHINGTON, D. C.—1937

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TRUE NORTH

MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION, 1937

Polyconic projection 1927 North American datum
10 000 foot grid based on Missouri (East) rectangular coordinate system
1000 meter Universal Transverse Mercator grid ticks zone 15, shown in black

To join Vineland map use dotted projection corners

TIFF, MO.

N3800—W90 37' 30"—7.5

1937

GTON 25, D. C.

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F REFERENCE WITHIN TEXT.

AT WERE ONLY MONITORED AND NOT TRAPPED.

AT WERE TRAPPED TWICE DUE TO PREVIOUS CAPTURE OF

38° 00'
90° 45'
430 000 FEET
(Potosi)
Glenn S Smith, Division Engineer
Topography by T V Cummins and Elmer Elshire
Surveyed in 1937

LEGEND

TRAP SITE NUMBER AND LOCATION

NOTE

PREPARED BY:

KENWILL, INC.
P.O. BOX 450
JACKSBORO, TN. 37757

UNDER DOD CONTRACT DACW 43-81-C-0103

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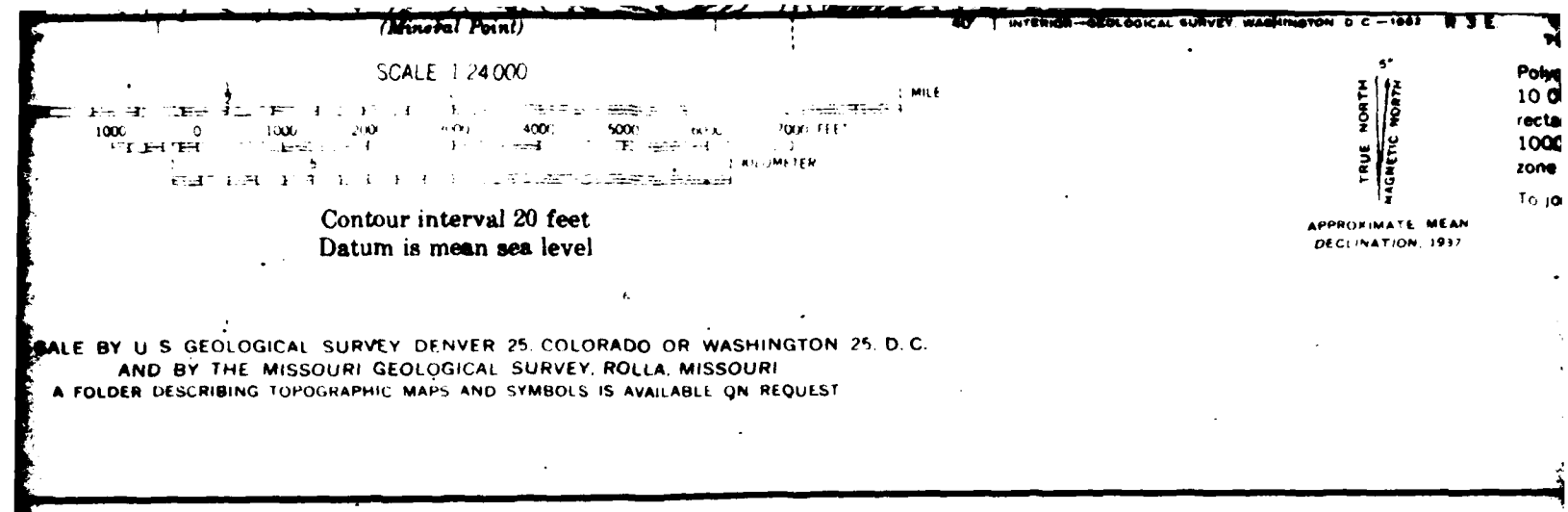

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3. THE R NUMBERS REFER TO SITES THAT WERE TRAPPED TWICE DUE TO PREVIOUS ENDANGERED SPECIES.

FIGURE:

3. TRAP SITES LOCATED WI
PORTION OF THE PINE FO

11

1 MILE

APPROXIMATE MEAN
DECLINATION, 1937

Polyconic projection. 1927 North American datum
10 000 foot grid based on Missouri (East)
rectangular coordinate system
1000 meter Universal Transverse Mercator grid ticks
zone 15, shown in black

To join Vineland map use dotted projection corners

TIFF, MO.
N3800—W9037.5/7.5
1937

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ORDER IN WHICH SITES WERE TRAPPED. THEY ARE
FERENCE WITHIN TEXT.

VERE ONLY MONITORED AND NOT TRAPPED.

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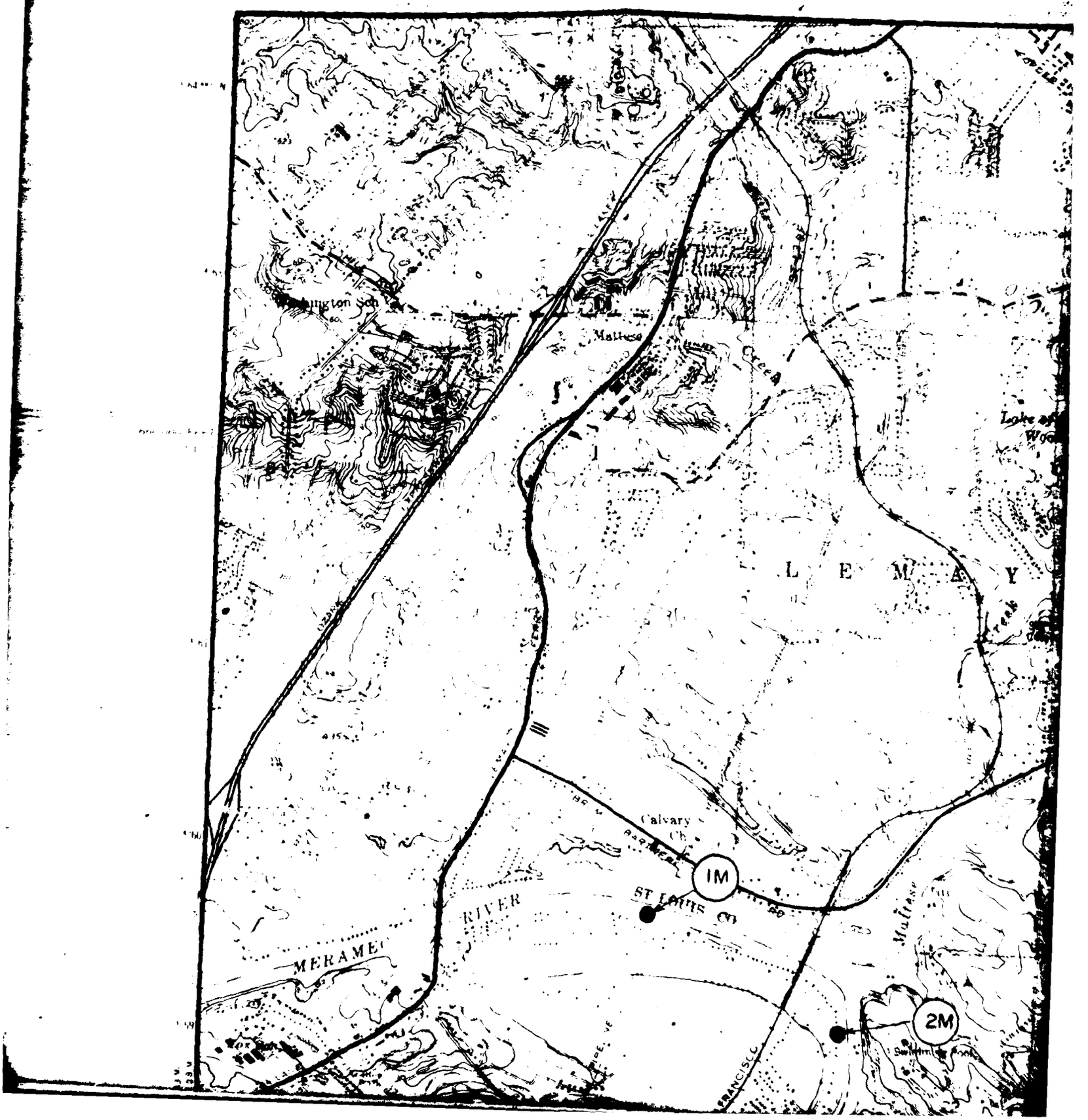
FIGURE:

3. TRAP SITES LOCATED WITHIN THE SOUTHERN PORTION OF THE PINE FORD STUDY AREA.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1M
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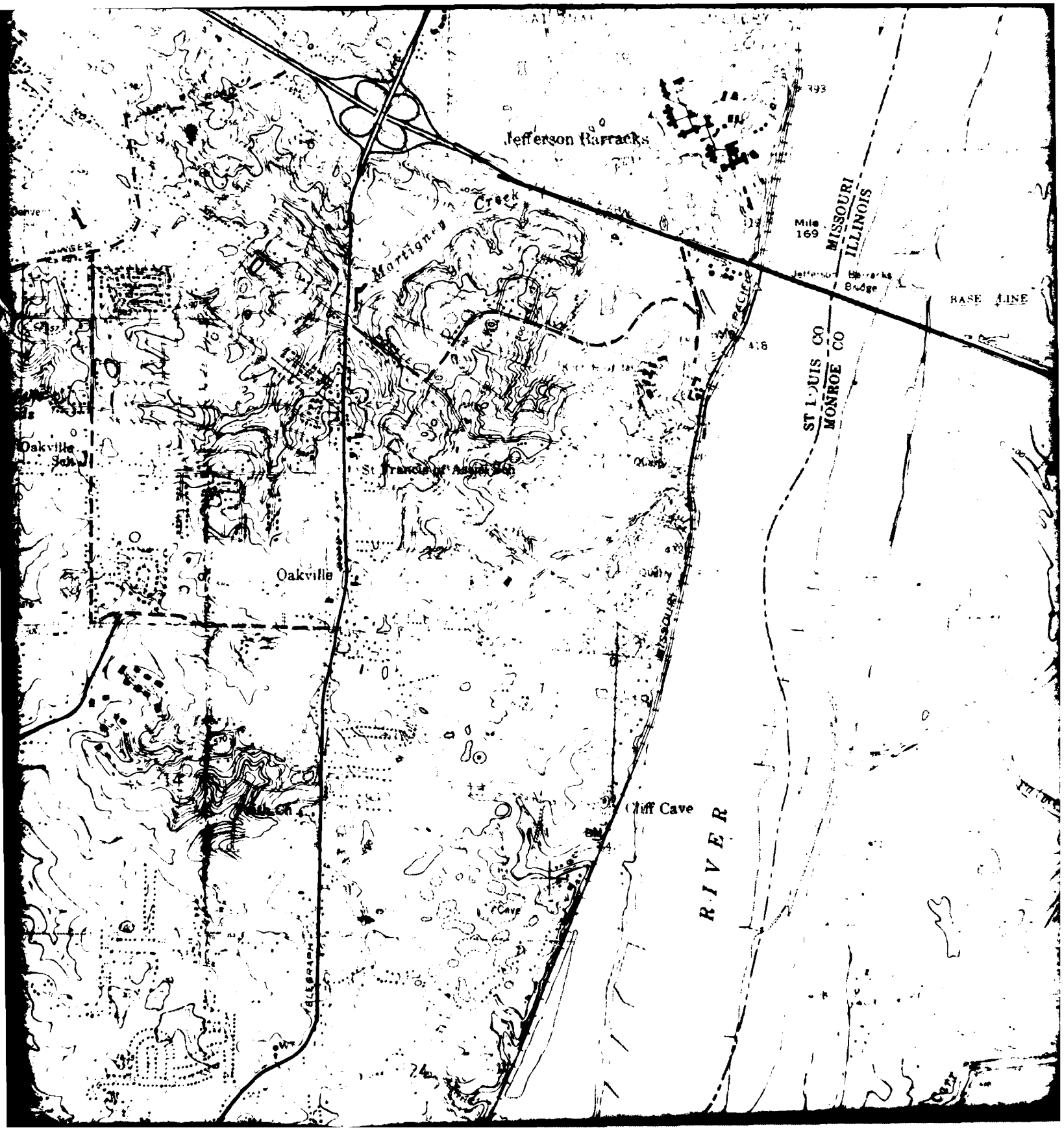
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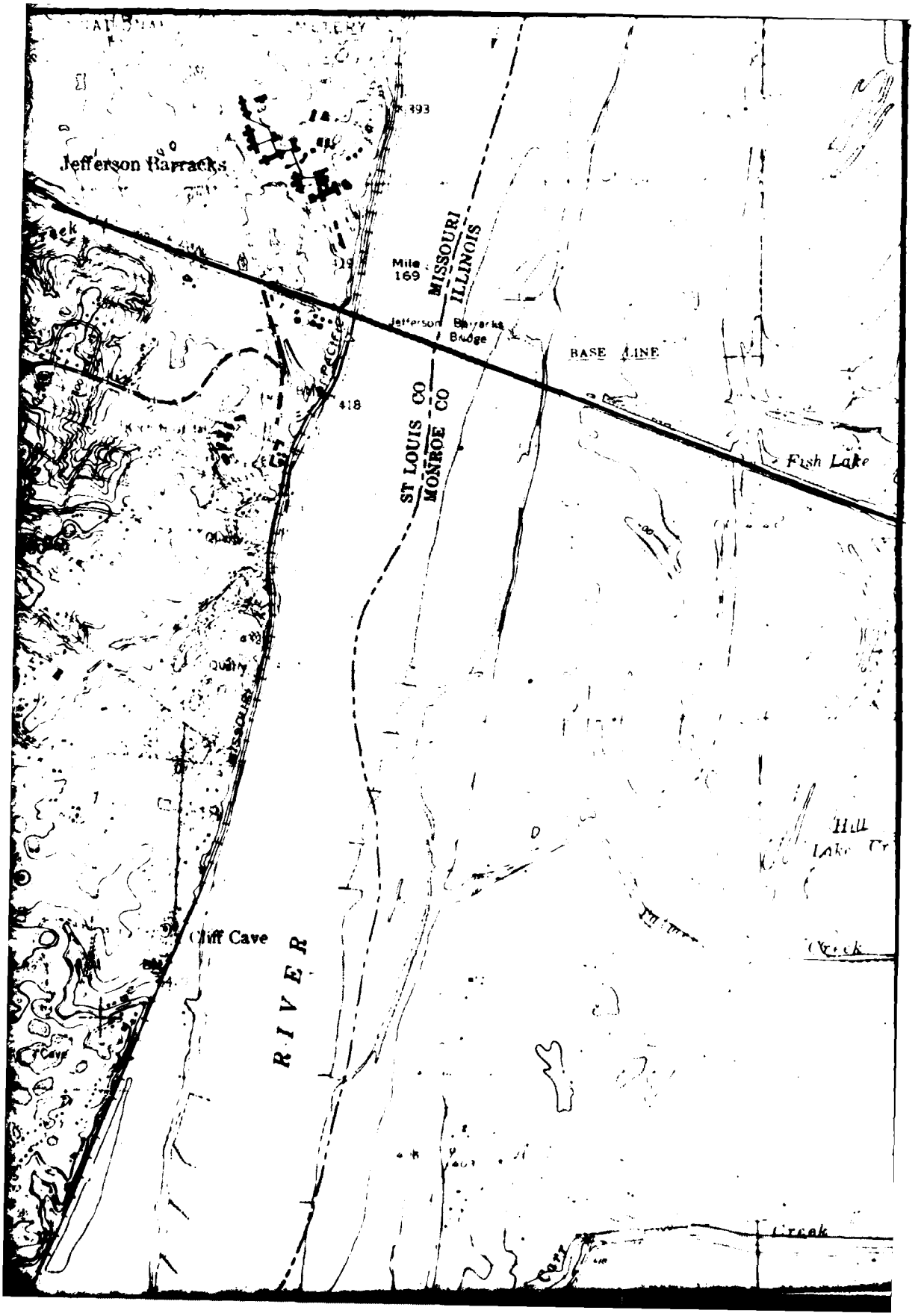
ST LOUIS CO
MONROE CO
Oakville
Cliff Cave
RIVER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ILLINOIS
Jefferson Barracks Bridge
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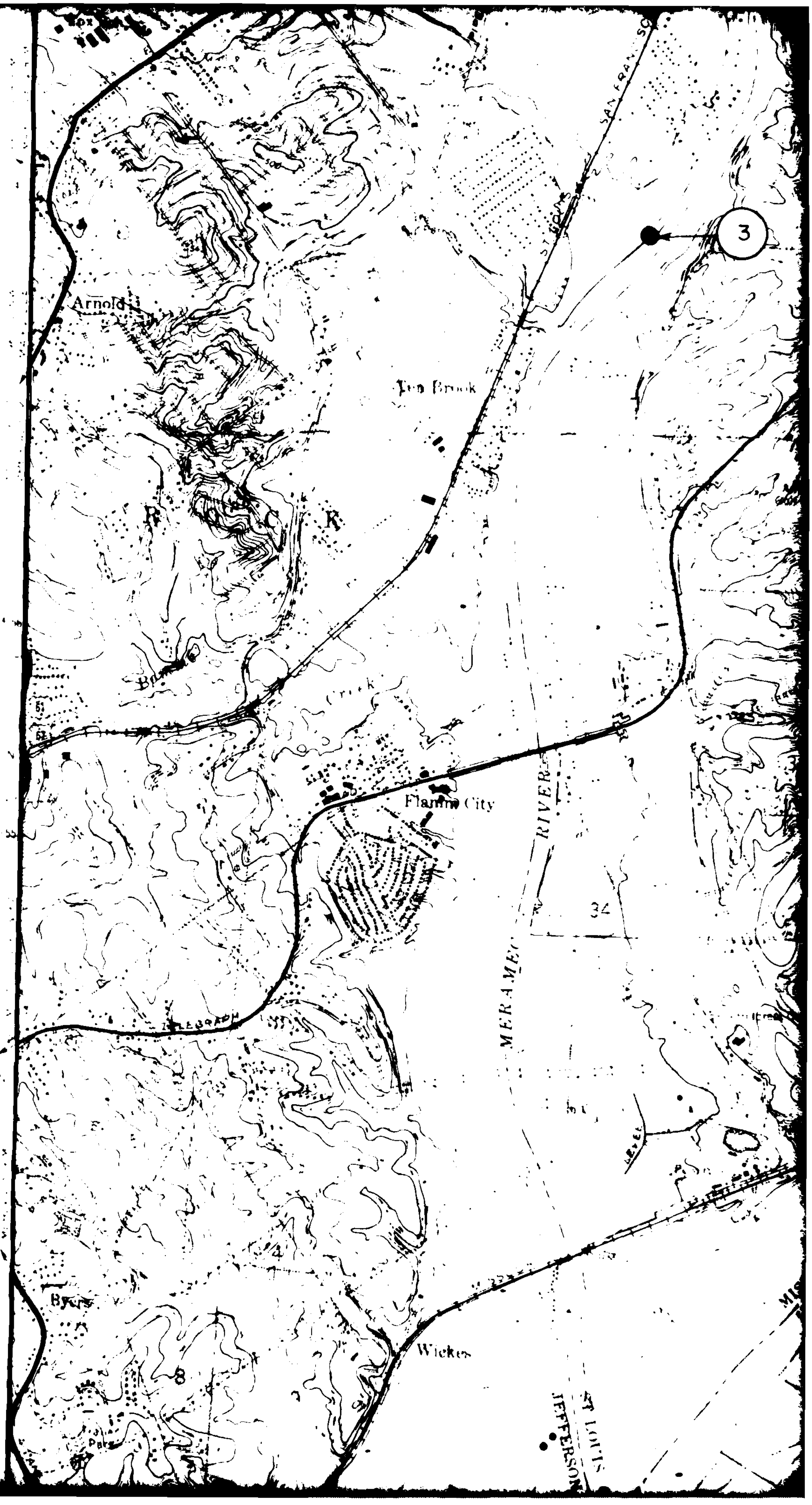
ST LOUIS CO
MONROE CO
Fish Lake
Cliff Cave
RIVER
Creek

4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Creek
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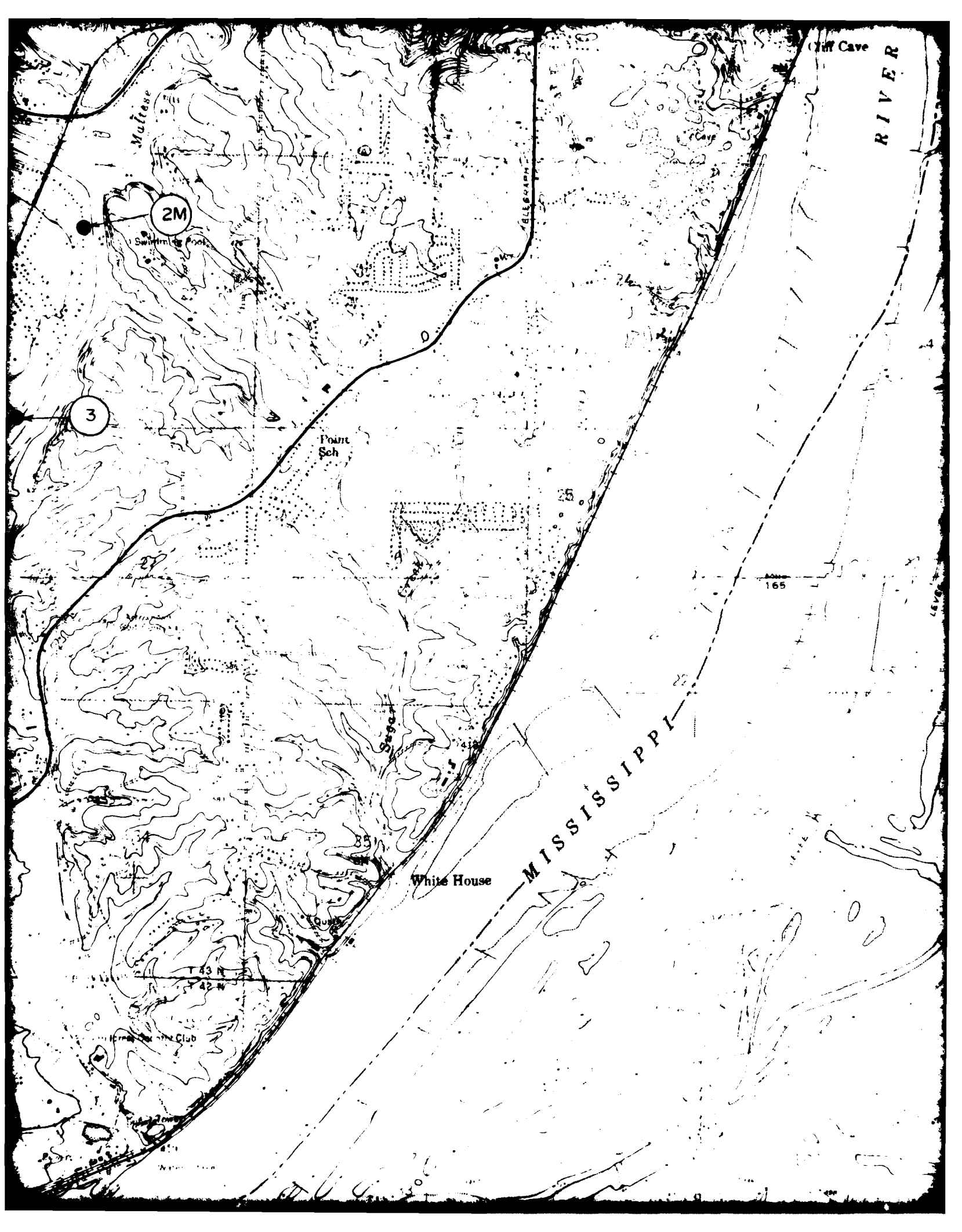
RIVER
34
TELEGRAPH
Byers
Wickes
ST LOUIS
JEFFERSON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2M
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MISSISSIPPI
White House
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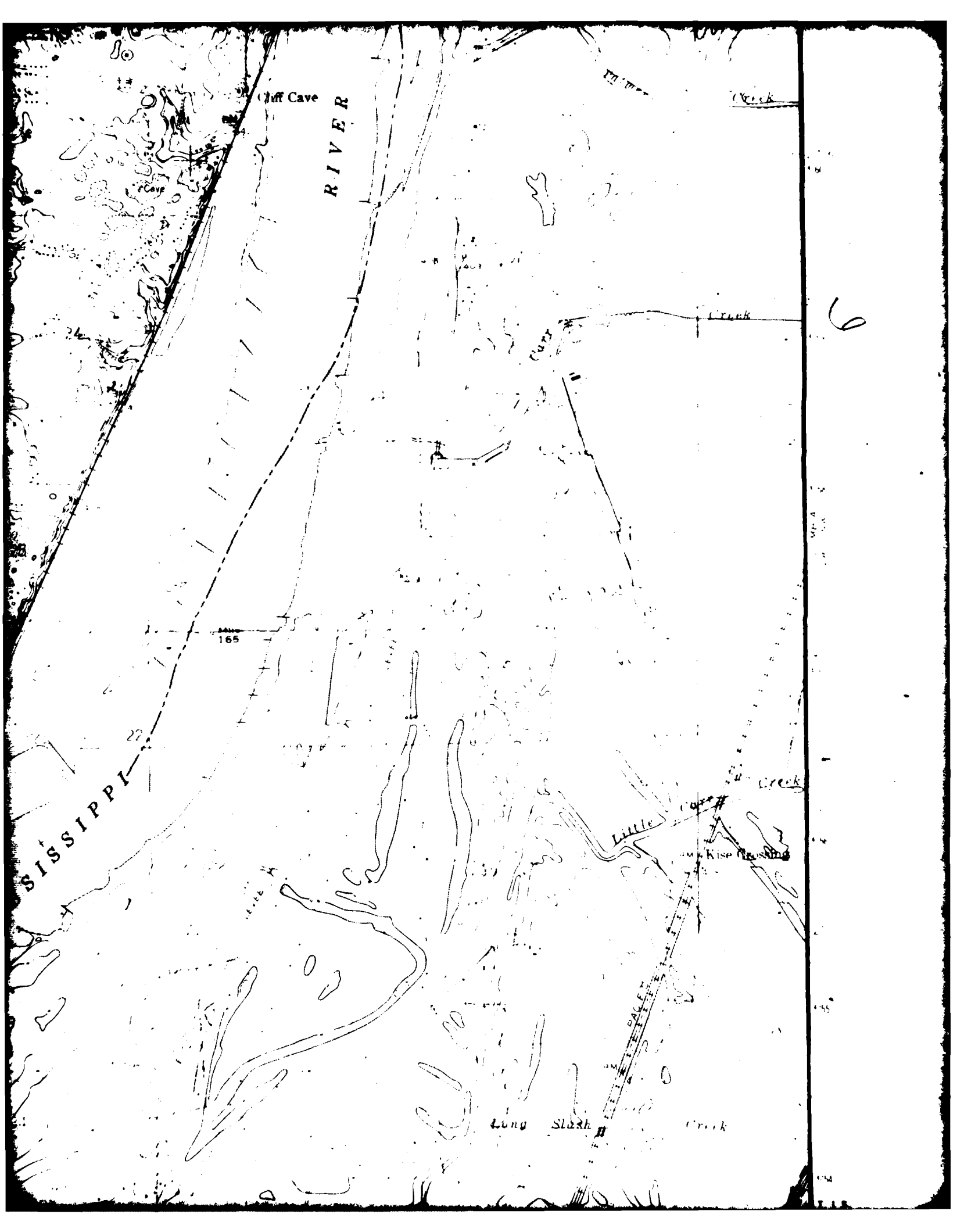
T 42 N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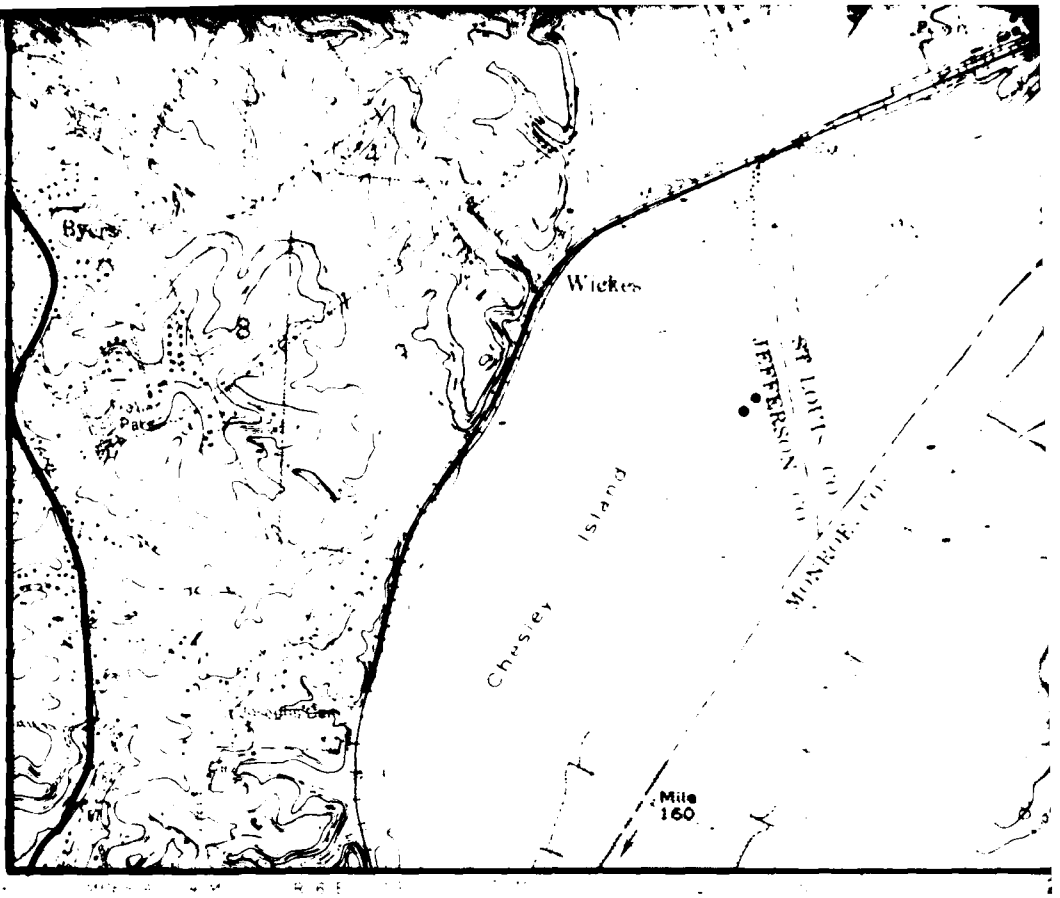
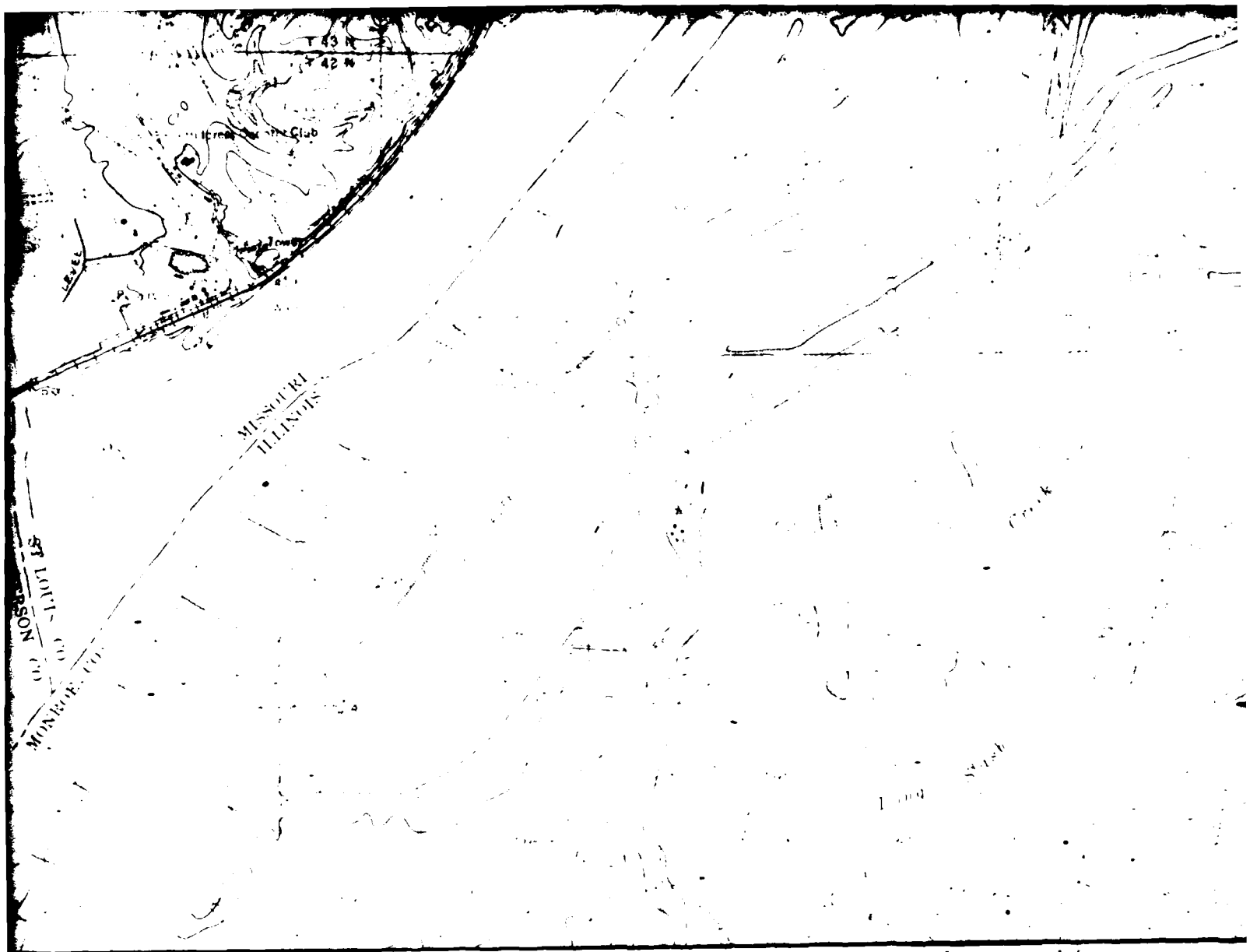
Cave
RIVER
Creek
Creek
165
SISSIPPI
Creek
Little
Long Slash
Creek
6



LEGEND

⊛ TRAP SITE NUMBER AND LOCATION

NO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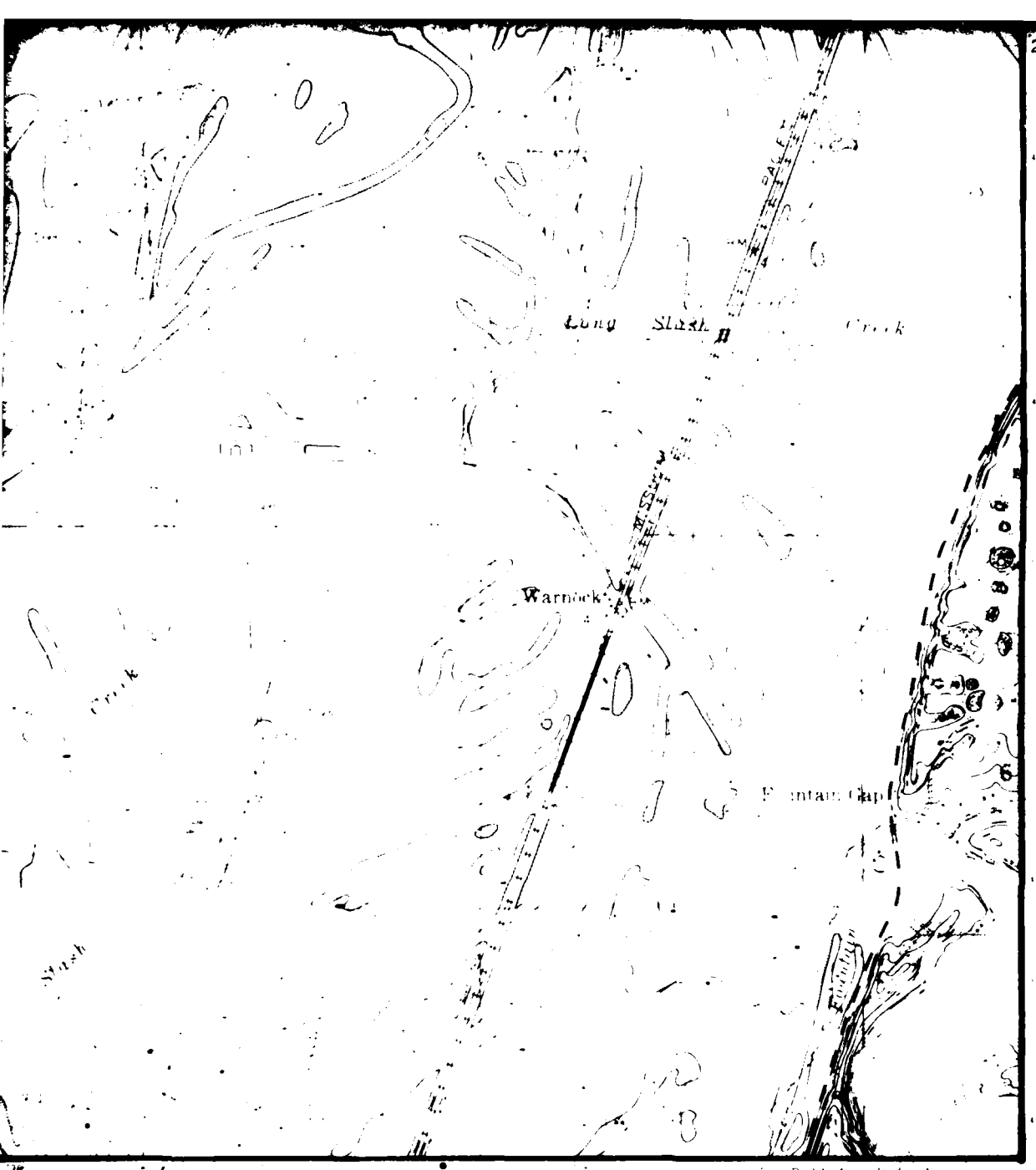
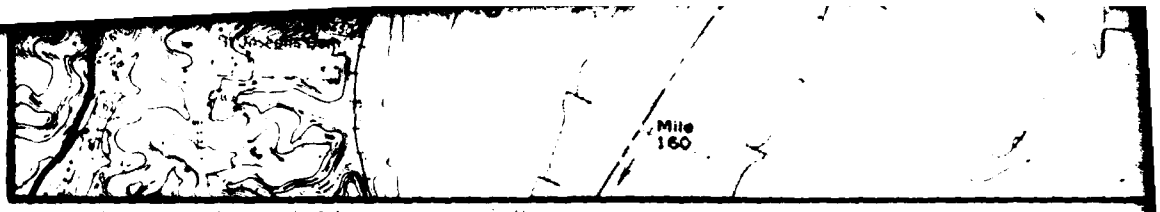
MISSOURI
ILLINOIS
ST LOUIS
MONROE CO.



OAKVILLE, MO.—ILL.

1954



LEGEND

TRAP SITE NUMBER AND LOCATION

NOTES:

1.

2.

3.

PREPARED BY:

KENWILL, INC.
P.O. BOX 450
JACKSBORO, TN. 37757

UNDER DOD CONTRACT DACW 43-81-C-0103

1. SITE NUMBERS DO NOT CORRESPOND TO THE ORDER IN WHICH SITES WERE TRAPPED. NUMBERED CONSECUTIVELY FOR EASE OF REFERENCE WITHIN TEXT.
2. THE M NUMBERS REFER TO SITES THAT WERE ONLY MONITORED AND NOT TRAPP
3. THE R NUMBERS REFER TO SITES THAT WERE TRAPPED TWICE DUE TO PREVIOU ENDANGERED SPECIES.

RDER IN WHICH SITES WERE TRAPPED. THEY ARE
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RE ONLY MONITORED AND NOT TRAPPED.

RE TRAPPED TWICE DUE TO PREVIOUS CAPTURE OF

LITERATURE CITED

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APPENDIX

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[a]						MALE	FEMALE	TOTAL[d]
33	81	6/29/81	36.6	0.91	Combo	20	19.8	4	Sy, Be	M. grisescens	1	0	1
										L. borealis	0	1	1
47	93	7/1/81	9.0	0.15	Gravel	95	15.0	4	Sy, Be, M		No bats captured		
48R	94	7/1/81	33.0	0.60	Combo	20	22.5	4	Sy, M	M. sodalis	2	1	3
49	95	7/2/81	21.0	0.75	Combo	30	22.5	3	Be, M	P. subflavus	3	2	5
										M. lucifugus	2	0	2
50	96	7/2/81	33.0	1.20	Combo	5	15.0	3	Sy, Be	P. subflavus	0	1	1
										N. humeralis	0	1	1
12	61	7/3/81	24.0	0.90	Gravel	10	21.0	3	Sy, M	L. cinereus	1	0	1
										P. subflavus	0	1	1
14	63	7/5/81	21.0	0.90	Combo	20	19.5	4	Sy, M	E. fuscus	1	0	2
										N. humeralis	0	1	1
15	64	7/5/81	36.0	0.90	Combo	--	21.0	4	M	P. subflavus	0	1	1
18	67	7/6/81	30.0	0.90	Combo	25	13.5	3	Sy		No bats captured		
19	68	7/6/81	31.5	0.90	Combo	5	22.5	4	Sy, M	L. cinereus	0	1	1
										N. humeralis	1	1	2
										M. leibii	0	1	1

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[a]						MALE	FEMALE	TOTAL[d]
51	N/A	7/7/81	27.0	0.3	Gravel	40	18.0	3	Sy	M. keenii	0	1	1
										P. subflavus	0	3	3
										L. borealis	4	2	6
										M. lucifugus	2	0	2
37	85	7/8/81	30.0	1.2	Combo	--	----	3	Sy, Be, M	L. borealis	2	0	2
										P. subflavus	2	0	2
36	84	7/8/81	33.0	0.3	Combo	20	22.5	4	Sy, M	P. subflavus	1	3	4
										N. humeralis	1	0	1
										L. borealis	1	0	1
44	91	7/9/81	45.8	0.9	Gravel	8	30.0	3	Sy, Be	L. borealis	1	1	2
42	90	7/9/81	30.0	0.6	Combo	45	18.0	3	M	L. borealis	1	0	1
										M. lucifugus	0	2	2
23	71	7/10/81	48.0	0.9	Combo	10	24.0	3	Sy, M	P. subflavus	1	0	1
										L. borealis	1	1	2
										N. humeralis	1	3	4
22R	71	7/10/81	12.6	0.2	Gravel	98	28.5	4	M	L. borealis	1	2	6
										M. sodalis	1	0	1
										N. humeralis	0	10	13
6	55	7/12/81	30.0	1.2	Combo	0	18.0	3	Sy		No bats captured		
8	56	7/12/81	36.0	0.6	Combo	5	19.5	3	M		No bats captured		
4	53	7/13/81	31.5	0.9	Combo	10	18.0	2	M	P. subflavus	0	1	1
										L. borealis	0	1	1

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[a]						MALE	FEMALE	TOTAL[d]
5	54	7/13/81	33.0	0.4	Combo	5	22.5	3	Sy	L. borealis	1	1	2
40	88	7/14/81	25.5	0.9	Combo	10	28.5	3	M	P. subflavus	1	1	2
										L. borealis	1	1	2
41	89	7/14/81	33.0	0.9	Combo	25	23.4	3	M	L. borealis	0	4	4
										N. humeralis	1	0	1
26	75	7/16/81	33.0	1.2	Combo	25	30.0	4	Sy, M	E. fuscus	1	0	1
										P. subflavus	1	1	2
										N. humeralis	1	2	3
										L. borealis	1	0	1
27	76	7/16/81	33.0	0.9	Combo	80	21.0	4	Sy, Be	L. borealis	0	2	3
										P. subflavus	0	1	1
										N. humeralis	0	1	1
										E. fuscus	1	0	1
29	78	7/17/81	27.0	0.6	Combo	60	21.0	4	M	P. subflavus	1	1	2
										N. humeralis	0	3	3
										L. borealis	2	2	4
28	77	7/17/81	30.0	0.6	Combo	55	----	4	Sy, M	L. borealis	8	1	11
										N. humeralis	2	2	4
										P. subflavus	0	1	1
										M. lucifugus	1	0	1
										E. fuscus	1	0	1
7R	55	7/22/81	7.5	0.9	Mud	100	16.5	3	M	P. subflavus	1	0	1
										L. cinereus	0	1	1
										M. keenii	1	0	1
										M. sodalis	0	1	1

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE [a]						MALE	FEMALE	TOTAL[d]
52	N/A	7/22/81	8.1	0.3	Combo	9	12.0	3	Sy, Elm	L. borealis	0	2	2
1M	50	7/23/81	42.0	3.0	Combo	5	----	3	Sy	Monitored Only			
43	91	7/26/81	7.5	0.3	Combo	100	16.5	3	Sy, M	L. borealis	1	1	2
35R	82	7/26/81	15.0	0.2	Combo	90	19.5	3	Be	N. humeralis	1	6	7
										M. grisescens	1	0	1
										E. fuscus	1	0	1
										L. borealis	4	5	11
										M. keenii	1	0	1
										P. subflavus	0	0	1
35R	82	7/29/81	39.0	1.2	Combo	60	13.5	3	Sy, M	L. borealis	2	1	4
										N. humeralis	0	1	1
										P. subflavus	1	1	2
										M. keenii	1	1	2
30	79	7/30/81	6.0	0.9	Gravel	100	19.5	3	Sy	M. sodalis	1	0	1
7R	55	7/30/81	Re-trap site-see 7/22/81							L. borealis	0	2	3
										P. subflavus	1	0	1
55	99	7/31/81	33.0	0.6	Combo	5	18.0	3	Sy, M	L. borealis	0	2	2
54	98	7/31/81	30.0	0.8	Gravel	40	----	3	Sy	P. subflavus	0	0	1
										L. borealis	5	2	7
										E. fuscus	1	0	1

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[a]						MALE	FEMALE	TOTAL[d]
34	82	8/2/81	31.5	0.9	Gravel	40	15.0	3	Sy, M	P. subflavus	1	1	2
										L. borealis	3	1	9
										M. grisescens	1	0	1
										M. lucifugus	1	0	1
										N. humeralis	0	1	1
53	97	8/2/81	24.0	0.9	Rock	55	24.0	3	Sy	L. borealis	10	5	17
										P. subflavus	3	1	6
										E. fuscus	2	0	2
38	86	8/3/81	39.0	0.6	Gravel	30	----	3	Sy, M	L. borealis	5	5	12
										P. subflavus	0	2	2
39	87	8/3/81	54.0	0.9	Sand	35	19.5	3	Be, M	N. humeralis	0	1	1
										L. borealis	2	3	5
										P. subflavus	1	2	3
24	73	8/4/81	45.0	1.0	Gravel	25	24.0	4	Sy, Be, M	P. subflavus	1	2	3
										L. borealis	2	2	5
										N. humeralis	0	3	3
25	74	8/4/81	30.0	0.9	Gravel	20	19.5	3	Sy, M	L. borealis	2	3	8
										P. subflavus	0	1	2
										N. humeralis	0	3	3
2	51	8/5/81	36.0	0.9	Gravel	50	24.0	4	Sy	L. borealis	1	2	4
										P. subflavus	0	1	1

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[d]						MALE	FEMALE	TOTAL[d]
45	92	8/7/81	33.0	0.6	Gravel	30	----	4	Sy, M	P. subflavus	3	0	5
										L. borealis	5	1	6
										N. humeralis	0	3	3
46	93	8/7/81	36.0	0.6	Gravel	100	24.0	4	Sy	L. borealis	5	9	26
										P. subflavus	1	1	4
										N. humeralis	1	2	3
										E. fuscus	1	1	2
32	80	8/8/81	33.0	0.8	Gravel	25	22.5	3	Sy, M	P. subflavus	1	2	3
										L. borealis	2	4	6
										N. humeralis	0	1	1
										L. cinereus	1	0	1
31	79	8/8/81	30.0	0.6	Combo	55	19.5	3	Sy, M	L. borealis	2	2	4
										P. subflavus	0	1	1
										M. lucifugus	2	0	2
										M. sodalis	1	0	1
17	66	8/9/81	30.0	0.8	Combo	100	22.5	3	Sy	L. borealis	1	4	6
										E. fuscus	1	1	3
										P. subflavus	0	1	1
16	65	8/9/81	22.5	0.9	Gravel	60	19.5	4	Sy, Oak	L. borealis	2	2	5
										M. sodalis	1	0	1
11M	60	8/10/81	33.0	2.0+	Gravel	60	15.0	3	Sy		Monitored Only		
10	59	8/10/81	36.0	0.6	Gravel	10	22.5	4	Sy, Be		No bats captured		

AD-A111 414 KENWILL INC JACKSBORO TN F/G 6/3
DETERMINATION OF PRESENCE AND HABITAT SUITABILITY FOR THE INDIA--ETC(U)
JAN 82 A R RABINOWITZ DACW43-81-C-0103
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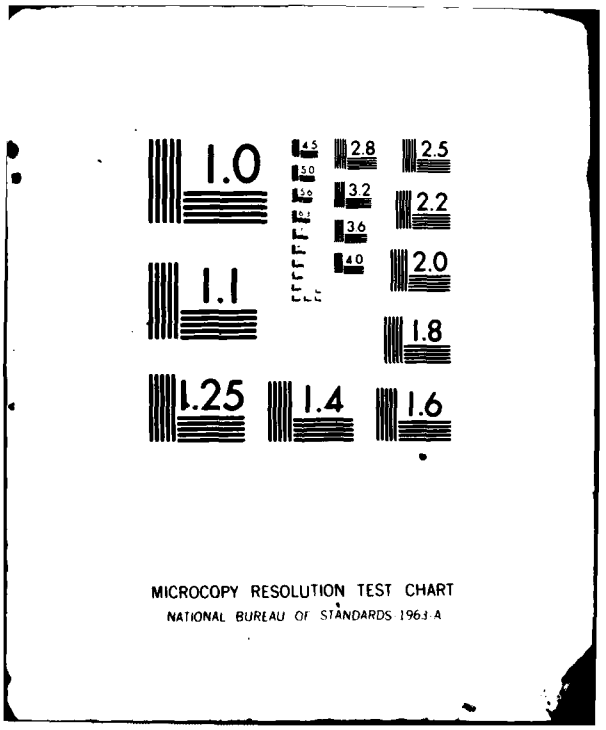
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

SITE DATA FOR BIG RIVER AND ITS TRIBUTARIES

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[a]						MALE	FEMALE	TOTAL[d]
21	70	8/11/81	18.0	0.2	Combo	80	16.5	3	Sy, Be, Elm	L. borealis	2	0	2
20	69	8/11/81	36.0	0.9	Combo	30	18.0	4	M	L. borealis	3	7	11
										M. sodalis	1	0	1
										P. subflavus	1	0	1
										N. humeralis	0	1	1
22R	71	8/12/81	Re-trap site-See 7/10/81							L. borealis	0	2	2
48R	94	8/12/81	Re-trap site-See 7/1/81							L. borealis	2	3	7
										E. fuscus	3	0	3
										M. grisescens	2	1	3
10	59	8/13/81	Re-trap site-See 8/10/81								Monitored Only		
9M	58	8/13/81	48.0	1.5+	Combo	15	22.5	3	Sy, M		Monitored Only		
16	65	8/13/81	54.0	0.3	Gravel	10	----	3	M	L. borealis	0	0	1

[a] Combo refers to a substrate composition of a mud, gravel, sand combination.

[b] Age class 1 = 0.0" to 4.9" dbh
Age class 2 = 5.0" to 10.9" dbh
Age class 3 = 11.0" to 15.9" dbh
Age class 4 = 16.0" + dbh

[c] Sy = Sycamore
Be = Box Elder
M = Maples

[d] Bats which were identified but escaped before being sexed, are included in the total count. Thus totals may be greater than the sum of the individual sexes.

SITE DATA FOR THE MERAMEC RIVER

SITE NO.	RIVER km	DATE	MAJOR STREAM CHARACTERISTICS			CANOPY COVER (%)	CANOPY HEIGHT (m)	DOMINANT AGE CLASS[b]	DOMINANT TREE SP.[c]	BAT SPECIES	BAT CAPTURE		
			WIDTH (m)	DEPTH (m)	SUBSTRATE[a]						MALE	FEMALE	TOTAL[d]
1M		8/14/81	75.0	2.0+	Mud	10	19.5	3	M	L. borealis	1	0	1
2M		8/14/81	No data taken. Conditions similar to Site #1.								Monitored Only		
3		8/14/81	No data taken. Conditions similar to Site #1.								Monitored Only		

[a] Combo refers to a substrate composition of a mud, gravel, sand combination.

[b] Age class 1 = 0.0" to 4.9" dbh
Age class 2 = 5.0" to 10.9" dbh
Age class 3 = 11.0" to 15.9" dbh
Age class 4 = 16.0" + dbh

[c] Sy = Sycamore
Be = Box Elder
M = Maples

[d] Bats which were identified by escaped before being sexed, are included in the total count. Thus totals may be greater than the sum of the individual sexes.


DAT
FILM